

Head & Neck

Text to Plates XIII - XXVIII

Ellis & Ford.

P. R. Cooper

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# ILLUSTRATIONS OF THE HEAD AND NECK.

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## DESCRIPTION OF PLATE XIII.

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THE base of the skull, with the cranial nerves, and the first and second stages of the dissection of the orbit, may be studied with the aid of this Figure.

After the removal of the brain, the fossæ and the dura mater in the base of the skull are visible without further preparation ; but the dissection required for the display of the cranial nerves and the contents of the orbit will be subsequently described.

### BASE OF THE SKULL AND THE DURA MATER.

The region called base of the skull is situate inside the cranium, and lies below the level of a line carried circularly round the head from the superciliary eminences in front to the occipital protuberance behind. It is divided into three fossæ on each side of the middle line ; and a strong fibrous membrane, the dura mater, lines the whole.

- A. Middle fossa of the base.
- B. Posterior fossa.
- C. Superior occipital fossa.
- D. Part of the tentorium, cut through.
- E. Part of the falx cerebri, also cut.

- F. Falx cerebelli.
- G. Straight sinus.
- H. Cribriform plate of the ethmoid bone.
- I. Crista galli of the ethmoid bone.
- K. Roof of the orbit raised.

The *anterior fossa* of the base lies over the orbit, and must be destroyed nearly altogether by the dissection of that space. For

the most part the surface of the fossa is convex, but along the middle line it is hollowed where it lodges the olfactory bulb: at the forepart of the hollow, H, small apertures exist in the cribriform plate of the ethmoid bone for the transmission of the olfactory nerve filaments to the nose. On the anterior fossa rest the frontal lobes of the large brain.

The *middle fossa*, A, receives the middle part of the cerebrum or large brain. Much deeper than the anterior fossa, its bottom will reach down to a level with the articulation of the lower jaw. Along the middle line is the depression (sella Turcica) on the body of the sphenoid bone containing the pituitary body. *Small vessels ramify in the fossa; and the internal carotid artery and some cranial nerves cross the inner end.*

The *posterior fossa*, B, is more extensive than the others, being wide and shallow, and contains the hemispheres of the small brain or cerebellum. Its depth will be marked on the side of the head by the tip of the mastoid process. In its centre is the large foramen magnum transmitting the spinal cord.

If the skull has not been sawn so low as the occipital protuberance, there will be another depression at the base, the *superior occipital fossa*, C, in which the posterior end or the occipital lobe of the large brain rests.

*Dura mater.* This is a strong fibrous membrane, which serves as an endosteum to the bone, and supports parts of the brain. Its vessels and nerves are named meningeal. Three chief processes project inwards between parts of the brain: two of these are met with in the examination of the base of the skull, and the third occupies the middle line of the head above the occipital protuberance.

The *tentorium cerebelli*, D (Plate xiv.), is arched over the posterior fossa of the base, leaving only a small aperture in front for the communication of the spinal cord with the brain; and it is interposed between the large and small brains. Uniting with it along its middle, above and below, are folds—the falx cerebri and falx cerebelli, which keep it fixed tightly. In its centre is a triangular venous space, the straight sinus, G.

The *falx cerebelli*, F, reaches from the occipital protuberance to



the foramen magnum, and is widest where it joins the tentorium. It contains the occipital sinus.

*Falx cerebri*, E. Only a small part of this is exhibited. It is narrowed in front and widened behind, and reaches along the middle line of the head from the crista galli, I, to the occipital protuberance where it joins the tentorium (Plate xiv.). At its attachment to the skull lies a venous space, the superior longitudinal sinus (Plate xiv. O).

*Meningeal arteries*. Small in size and few in number, they ramify in the dura mater of the fossæ, taking the names anterior, middle, and posterior, from their situation. Few of them are seen in an ordinary injection, and they will be noticed more fully after the cranial nerves.

*Meningeal nerves*. These are smaller than the arteries, and cannot be perceived without steeping the dura mater in acid : they are derived from the sympathetic, and from some of the cranial nerves, especially the fifth.  $\gamma \times$ .

#### CRANIAL NERVES IN THE BASE OF THE SKULL.

All the nerves attached to the encephalon are called cranial ; and one nerve, 11, not attached to the encephalon, is reckoned as a cranial nerve, because it enters the skull and leaves by an aperture in the base of the cranium. The nerves course forwards from their origin to the apertures of exit ; and a part of each nerve is left in the skull after the removal of the brain.

The nerves crossing the middle fossa of the base of the skull are invested by sheaths of the dura mater, but the others are free from the same till they enter their foramina of exit. On the left side, the place of entrance of those nerves into the sheaths may be observed ; but to examine fully their trunks, and to define also the ganglion and branches of the fifth nerve, as in the Figure, the dura mater should be removed on the right side from the middle fossa of the base.

There are twelve pairs of cranial nerves :\*—these are marked by

\* English anatomists reckon in general nine pairs of cranial nerves, and the anatomists on the Continent enumerate twelve pairs ; so that some confusion

corresponding numerals, except in the case of the first nerve which has been removed with the brain.

- |                                   |                               |
|-----------------------------------|-------------------------------|
| 2. Optic nerve and commissure.    | 10. Pneumogastric nerve.      |
| 3. Motor nerve of the eyeball.    | 11. Spinal accessory nerve.   |
| 4. Trochlear nerve.               | 12. Hypoglossal nerve.        |
| 5. Trifacial nerve.               | 13. Gasserian ganglion.       |
| 6. Abducent nerve of the eyeball. | 14. Ophthalmic nerve.         |
| 7. Facial nerve.                  | 15. Superior maxillary nerve. |
| 8. Auditory nerve.                | 16. Inferior maxillary nerve. |
| 9. Glosso-pharyngeal nerve.       | 17. Large petrosal nerve.     |

The *olfactory*, or *first cranial nerve*, is marked by a bulb which rests on the cribriform plate of the ethmoid bone, and sends filaments to the nose through the subjacent apertures: it will be found attached to the brain.

The *optic*, or *second nerve*, 2, ends in the eyeball. Posteriorly the nerves of opposite sides unite in a commissure (*chiasma*) on the olivary eminence of the sphenoid bone, with a partial decussation of their fibres. In front the nerves diverge; and each issues from the skull through the optic foramen, with the ophthalmic artery. In the orbit of the left side the further course of the nerve to the eyeball is evident.

The *motor oculi*, or *third nerve*, 3, crosses the middle fossa, and enters its sheath of dura mater behind the anterior clinoid process, as seen on the left side. Contained in the dura mater, it is conveyed to the sphenoidal fissure, and supplies all the muscles moving the eyeball, except two.

The *trochlear*, or *fourth nerve*, 4, is received into a sheath of dura mater behind the posterior clinoid process, and courses forwards through the wall of the cavernous sinus to end in one muscle in the orbit—superior oblique.

The *trifacial*, or *fifth nerve*, 5, consists of two roots, large and

in the nomenclature arises from this difference in the mode of numbering. The enumeration of the nerves as twelve appears most natural, as only two nerve trunks, with like function and distribution, will then be included in one cranial pair; whilst, in using the smaller number, as many as four and six trunks, differing in name, function, and distribution, will be combined together as one pair of the cranial nerves.

small, though only the large root is visible, for this lies over and conceals the small root.

The *large root* enters a sheath of dura mater above the petrous portion of the temporal bone, and swells into a large ganglion in the middle fossa of the skull.

This ganglion, 13, named Gasserian, and about as large as the thumb-nail, is widened in front, and is crossed by a ridge to which the dura mater adheres closely. From the fore part of the ganglion three large trunks are sent forwards to end on the face, hence the origin of the name of the nerve:—the highest of these is the ophthalmic trunk, 14, which passes through the sphenoidal fissure to the orbit; the middle one, or the superior maxillary, 15, leaves the skull by the foramen rotundum; and the third, the inferior maxillary nerve, 16, issues from the skull through the foramen ovale. These trunks of the ganglion confer sensibility on the parts to which they are distributed.

The *small root* of the fifth lies under the large one, and will come into view on raising the ganglion; it is unconnected with the ganglion, and belongs exclusively to the inferior maxillary trunk. Blending with offsets of the inferior maxillary trunk outside the skull, it is conveyed to muscles, and chiefly to those of mastication, to which it gives the power of contracting.

The *abducent*, or *sixth nerve*, 6, pierces the dura mater behind the body of the sphenoid bone, and entering the cavernous sinus, passes through the sphenoidal fissure to one muscle (external rectus) of the orbit.

All the nerves crossing the middle fossa of the base of the skull, viz., the third, fourth, fifth, and sixth, communicate with the sympathetic on the carotid artery.

The *facial*, or *seventh nerve*, 7, (portio dura of the seventh pair, Willis,) enters the meatus auditorius internus. In the bottom of that hollow it is received into the aqueduct of Fallopius, and is conveyed to the stylo-mastoid foramen, where it escapes, to be distributed to the muscles of the face, the head, and the ear (in part); it is the motor nerve of those muscles.

The *auditory*, or *eighth nerve*, 8, (portio mollis of the seventh pair, Willis,) soft, and divided into fibrils, accompanies the facial

into the meatus auditorius, and passes through the small apertures in the bottom of that meatus, to end in the inner parts of the ear.

The *glosso-pharyngeal*, or *ninth nerve*, 9, (part of the eighth pair, Willis,) leaves the skull by the foramen jugulare, being contained in a distinct sheath of dura mater, and lying in a depression in the lower border of the temporal bone. It is distributed, as the name expresses, to the tongue and pharynx.

The *pneumogastric*, or *tenth nerve*, 10, (part of the eighth pair, Willis,) is transmitted through the foramen jugulare in a sheath of dura mater common to it and the following nerve. It is a flat trunk, consisting of fibrils. Its terminating branches ramify in the air passages, the heart, and the alimentary canal.

The *spinal accessory*, or *eleventh nerve*, 11, (part of the eighth pair, Willis,) is the only cranial nerve that is not united with the encephalon. Arising from the spinal cord, it enters the skull through the foramen magnum; it then bends outwards to the foramen jugulare, and leaves the cranium through that hole in close contiguity to the pneumogastric—the two being contained in the same fibrous sheath. This nerve supplies in part two muscles of the neck—the sterno-mastoid and trapezius.

The *hypoglossal*, or *twelfth nerve*, 12, (ninth pair, Willis,) consists of two bundles of filaments, which pierce separately the dura mater. These join in the anterior condyloid foramen, by which they issue from the cranium as one trunk. It is a motor nerve of some of the hyoid, and the tongue muscles.

*Large petrosal nerve*, 17. This is a continuation of the Vidian nerve, derived from Meckel's ganglion. Coming into the skull through the pterygoid foramen and over the foramen lacerum in the base, it is conveyed in a bony groove under the Gasserian ganglion to the hiatus Fallopii, which it enters to join the facial nerve in the temporal bone.

#### VESSELS IN THE BASE OF THE SKULL.

Two large arteries on each side, carotid and vertebral, pass through the base of the skull in their course to the brain, and furnish some offsets to the dura mater. Other meningeal vessels,



supplied from arteries outside the cavity of the skull, ramify in the dura mater.

- a. Internal carotid artery.
- b. Vertebral artery.
- c. Large meningeal artery.

- m. Posterior meningeal artery.
- n, n. Anterior meningeal arteries.

The *internal carotid artery*, *a*, issues from the carotid foramen in the apex of the temporal bone, and winding through the cavernous sinus (Plate xiv.), touches the brain at the inner end of the fissure of Sylvius, and splits into branches (cerebral) for the supply of the large brain or cerebrum. On the side of the sphenoid bone it makes two bends, lying internal to the cranial nerves; and at the base of the brain it is placed between the second and third nerves.

An ophthalmic branch, and small offsets to the dura mater, spring from this part of the carotid.

The *vertebral artery*, *b*, is a branch of the subclavian trunk, and enters the skull through the foramen magnum: the arteries of opposite sides soon coalesce, and they supply the small, and part of the large brain. An offset is furnished by it to the dura mater.

*Meningeal arteries.* Small arteries ramify in each fossa of the base of the skull: they are named anterior, middle, and posterior, like the fossæ.

The *anterior set*, two in number, *n, n*, and the smallest, are branches of the ophthalmic artery in the orbit: they come from the anterior and posterior ethmoidal arteries, and entering the skull at the edge of the cribriform plate, end in the middle part of the fossa. One sends a twig to the front of the falx cerebri, E.

The *middle set*, three in number, are derived from branches of the external carotid artery, and appear through the lacerated, oval, and spinous foramina. The largest of these, and the only one generally injected, is the following:—

The middle meningeal artery, *c*, nourishes chiefly the bony case containing the brain. Arising from the internal maxillary artery, it comes inwards through the foramen spinosum, and ascends to the top of the head, grooving the bones—more particularly the lower and fore parts of the parietal. At the vertex of the skull it

terminates in the bone, but some branches communicate with the arteries on the outer surface of the cranium.

Branches are given by it to the dura mater. A petrosal branch enters the hiatus Fallopii with the small nerve, 17, to supply the temporal bone; and one or two offsets penetrate into the orbit, and join the ophthalmic artery.

The *posterior set* includes two arteries: one is furnished by the occipital through the foramen jugulare, and the other, by the vertebral artery inside the skull. Of the two, the offset, *m*, from the occipital is the largest, and it extends even to the tentorium cerebelli.

*Veins.* No vein accompanies either the internal carotid or the vertebral vessels which end in the brain; but companion veins run with the arteries distributed to the dura mater and the brain case. The veins with the large middle meningeal artery may be plainly seen in a dissection.

#### CONTENTS OF THE ORBIT.

In the orbit is lodged the eyeball with its muscles, vessels, and nerves. And the gland for the secretion of the tears is contained in the fore part of the same cavity.

The dissection of this cavity requires some care in its execution, in consequence of the smallness of the vessels and nerves, and of the quantity of fat with which they are surrounded.

On the right side the first stage of the dissection has been prepared by sawing through and throwing forwards the bony roof; and then slitting along the middle, and removing the periosteum of the cavity. On the left side, the cavity having been opened as before, the superficial layer has been taken away, to bring into view deeper vessels and nerves.

#### SUPERFICIAL MUSCLES AND THE LACHRYMAL GLAND.

The muscles contained in the orbit act on the eyeball, with the exception of one which raises the upper eyelid. Six muscles are attached to the eyeball; of these, four are straight, and direct the

pupil to opposite points of the circumference of the orbit; whilst two, which are named oblique, roll the ball.

|                                 |  |
|---------------------------------|--|
| L. Lachrymal gland.             | R. Upper rectus muscle.                |
| M. Eyeball of the left side.    | S. External rectus muscle.             |
| N. Upper oblique muscle.        | T. Pulley of the upper oblique muscle. |
| P. Levator palpebræ superioris. |  |

The *lachrymal gland*, L, lies above the muscles in the outer part of the orbit, and touches in front the upper eyelid. Shaped somewhat like an almond, with its longest measurement directed transversely, it is suspended by fibrous tissue to the roof of the orbit. It secretes the tears; and its ducts, six or eight in number, open along an arched line on the inner surface of the upper lid, near the outer end.

The *upper oblique muscle*, N, (trochlearis) is the longest muscle in the orbit, and passes through a ring, or pulley. It arises from the frontal bone, close to the optic foramen in the bottom of the orbit; and ends anteriorly in a tendon, which is directed backwards through the pulley, but beneath the upper rectus, and is inserted into the eyeball behind the centre (Fig. xiv.).

The trochlea or pulley, T, is a ring of fibro-cartilage, which is attached to the pit near the inner angle of the frontal bone. A synovial membrane lines the ring, and fibrous tissue is prolonged from the margins along the tendon.

The muscle draws inwards somewhat the back of the eyeball, rotating it at the same time; and it gives to the pupil an inclination downwards and outwards towards the top of the shoulder. By this action it is thought to control the movement downwards and inwards of the eye by the inferior rectus muscle.

The *levator palpebræ superioris*, P, arises in the bottom of the orbit, close to the preceding; becoming tendinous in front of the eyeball, it enters the upper eyelid, and is inserted into the fore part of the tarsal cartilage.

The muscle elevates the upper eyelid, moving upwards the fibro-cartilage over the eyeball, and gives rise to a deep groove in the skin. If the eyeball is directed down when the muscle is acting,

the elevation of the lid is checked by the mucous membrane which is then less loose.

*Recti muscles.* The upper rectus, R, (*attollens oculi*) and the outer rectus, S, (*abductor oculi*) have a common origin with the other two recti, around the optic nerve, at the apex of the orbital cavity; and they are inserted into the eyeball about a quarter of an inch behind the cornea.

The outer rectus is provided with an additional origin from a point of bone on the lower edge of the sphenoidal fissure, near the inner end of that slit: between this head and the common one the ophthalmic vein and several nerves pass.

The pupil is directed upwards and inwards by the upper rectus muscle, and outwards by the other rectus—the insertion of the muscles into the ball in front of its greatest transverse diameter impressing on the eye the movements stated. Squinting upwards or outwards may result from permanent contraction of the muscle moving the eye in the direction indicated, or from the rectus in action being unbalanced through paralysis of its antagonist muscle or muscles.

#### VESSELS OF THE ORBIT.

The ophthalmic artery and vein are represented in the left orbit. These vessels have some peculiarities:—they are not transmitted through the same aperture in the bone; and the vein, which is a single trunk, ends in the cavernous sinus in the interior of the skull.

d. Ophthalmic artery.

e. Anterior ethmoidal or nasal artery.

f. Posterior ethmoidal artery.

g. Supra-orbital artery.

h. Ophthalmic vein.

The *ophthalmic artery*, d, is a branch of the internal carotid, and enters the orbit through the optic foramen, lying below and outside the optic nerve. In the left orbit the artery is shown coursing over the optic nerve, and along the inner side to the front of the cavity, where it ends in branches for the root of the nose (nasal) and the forehead (frontal). Most of its offsets are distributed in the orbit.



*Offsets for the eyeball.* Several branches, *posterior ciliary*, pierce the back of the eyeball around the optic nerve. Other smaller arteries, which are usually not injected, enter the front of the ball, close to the cornea : these are the *anterior ciliary*, and they are best seen in inflammation of the iris. One artery enters the optic nerve behind the ball ; it ramifies in the retina, and is called the *central artery of the retina*.

The *lachrymal branch* accompanies the nerve, 19, to the gland of the same name.

*Muscular branches* arise at intervals : some of these are seen in the Figure.

*Eyelid offsets.* Each eyelid receives a *palpebral* branch : these are directed transversely, in contact with the tarsal cartilages, and anastomose externally with the lachrymal—forming an arch in each lid.

*Branches leaving the orbit.* Besides the two terminal branches (frontal and nasal), three others leave the cavity. One, *anterior ethmoidal*, *e*, accompanies the nasal nerve to the nose, and supplies meningeal offsets. Another, *posterior ethmoidal*, *f*, smaller than the preceding, passes through the foramen of the same name to the dura mater in the anterior fossa of the skull. And the third, *supra-orbital*, *g*, runs with the nerve of the same name through the supra-orbital notch to the forehead.

The *ophthalmic vein*, *h*, taking the same general course as the artery, joins in front the facial vein ; and as its branches correspond mostly with those of the artery few are delineated. At the back of the orbit it leaves the artery, and passing between the heads of the outer rectus, ends in the cavernous sinus in the skull (Plate xiv. Q).

*Eyeball veins* :—These differ from the arteries of the ball in their number and course. Four in number, they issue on opposite sides of the eye, and about midway between the cornea and the entrance of the optic nerve.

#### NERVES OF THE ORBIT.

Five cranial nerves enter the orbital cavity, viz. 2nd, 3rd, 4th, 5th, (in part) and 6th ; and all, except the second or optic,

come through the sphenoidal fissure. Some end in the contents of the orbit, like the arteries, and others are transmitted through the cavity to the nose and the forehead: they have the following general distribution. The second or the optic belongs to the eyeball. The third, fourth, and sixth, are furnished to muscles. And the ophthalmic trunk of the fifth nerve supplies the eyeball and the lachrymal gland, and ends outside the orbit.

The nerves which are superficial to the muscles are displayed on the right side, viz. the fourth, and the supra-orbital and lachrymal branches of the fifth: on the left side the other nerves referred to in the description may be observed.

|                                    |                                      |
|------------------------------------|--------------------------------------|
| 2. Optic nerve.                    | 18. Supra-orbital nerve.             |
| 3. Third nerve.                    | 19. Lachrymal nerve.                 |
| 4. Fourth nerve.                   | 21. Upper branch of the third nerve. |
| 14. Ophthalmic nerve of the fifth. | 23. Continuation of the nasal nerve. |

The *third cranial nerve*, 3, (motor oculi) supplies all the muscles of the eyeball except two, and enters the orbit in two pieces between the heads of the external rectus. The upper and smaller part, 21, (left side) is furnished to the levator palpebræ, P, and the upper rectus, R; the lower portion of the nerve may be seen in Plate xiv. 22.

The *fourth cranial nerve*, 4, passes through the sphenoidal fissure above the muscles, and ends in the upper oblique, N, piercing the fibres of the muscle on the surface turned away from the eyeball.

The *ophthalmic nerve*, 14, begins in the Gasserian ganglion, 13, and is continued through the wall of the cavernous sinus and the sphenoidal fissure to the orbit. It ends by dividing into the supra-orbital, 18, and the lachrymal branch, 19; and from its inner side, before the terminal bifurcation, springs the nasal nerve, 20, (Fig. xiv.)

The *lachrymal nerve*, 19, the smallest of the offsets of the ophthalmic trunk, is directed to the outer part of the orbit, and supplies the lachrymal gland and the upper eyelid.

The *supra-orbital nerve*, 18, lies above the muscles, like the lachrymal, and is continued through the cavity to the supra-

orbital notch, where it issues on the forehead, and supplies the muscles and the integuments. From its inner side is given a long slender branch, *supra-trochlear*, to the upper eyelid and the forehead; and as it turns round the margin of the orbit, small *palpebral* filaments are furnished to the upper eyelid.

The *nasal nerve* (20 left side) ends in the nose, and passes through the orbit and the cavity of the skull before it reaches its destination. Entering the orbit between the heads of the external rectus (Plate xiv.) it is continued forwards with the ophthalmic artery to the anterior of the two foramina in the inner wall (23, left side); here it is transmitted to the cavity of the skull. In the orbit its offsets are the following:—

Firstly, there is a slender communicating branch to the lenticular ganglion (Plate xiv. 26). As it crosses the optic nerve two or three filaments, *long ciliary*, are furnished to the eyeball. And as it leaves the orbit it gives a branch—*infra-trochlear*, 24, to the upper eyelid and the side of the nose.

The nasal nerve is distributed finally to the mucous membrane of the front of the nasal cavity, and to the integuments of the end of the nose. Irritation of it in the nasal cavity, as in taking snuff, induces sneezing for the purpose of removing the irritating body.

*Sixth cranial nerve*, 6. The ending of this nerve in the external rectus is delineated in Fig. xiv.

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## DESCRIPTION OF PLATE XIV.

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In the Drawing a view is obtained of the dura mater at the base of the skull, with the cavernous sinus; and the dissection of the orbit is carried through its two deeper stages.

Parts delineated in this and the preceding Plate are marked by the same letters and figures.

## THE DURA MATER WITH THE SINUSES.

The *tentorium cerebelli*, D, has been left entire for the purpose of showing the height and extent of this partition. Its position will be marked on the surface by a line on a level with the part of the ear joining the side of the head.

Venous spaces occupy the middle part, and the attached edge of the membrane ; and one of the largest spaces, called the cavernous, is close to each anterior extremity.

The *cavernous sinus*, Q, may be opened, as on the left side, by cutting through the dura mater from the anterior clinoid process to the petrous portion of the temporal bone, the cut being made internal to the third and fourth nerves.

This hollow is placed on the side of the body of the sphenoid, and reaches from the sphenoidal fissure to the temporal bone. Rather more than an inch long, it measures across about half an inch, after the handle of the knife has been put into it ; and it is dilated behind where it joins other sinuses. Its inner boundary is formed by the sphenoid bone covered by thin dura mater ; and the outer boundary, consisting of thickened dura mater, contains the third, 3, fourth, 4, and the ophthalmic trunk of the fifth nerve, 14, Plate xiii.

Through the inner part of the space pass the internal carotid artery and the sixth cranial nerve ; and these are separated from the blood by the thin venous lining membrane. Small fibrous bands and arteries traverse the space, giving rise to the term "cavernous."

Blood is received from a few small cerebral veins which pierce the outer wall, though chiefly from the ophthalmic vein (Fig. xiii. *h*) which enters in front ; and it circulates backwards to be conveyed to the lateral sinus by the upper and lower petrosal sinuses. The blood in the space communicates with that outside the head by means of small emissary veins, which penetrate through the foramen lacerum.

Three short sinuses join the cavernous spaces of opposite sides across the middle line ;—one lying before the pituitary body, one behind it ; and the other across the basilar process of



the sphenoid bone. No valves exist in these cross channels, so that the blood can move freely forwards and backwards through them; and should the diminished size or the absence of one lateral sinus interfere with, or stop the course of the blood on that side of the skull, the circulating fluid can be conveyed across the middle line, to be transmitted from the head by the lateral sinus of the opposite side.

The *internal carotid* artery, *a*, winds through the space from behind forwards, and issues through the *dura mater* internal to the anterior clinoid process: it furnishes here small *receptacular* branches to the *dura mater*.

Ascending around the artery is the cranial part of the *sympathetic nerve*, which communicates with the nerves entering the orbit through the sphenoidal fissure.

In the sinus lies the *sixth cranial* nerve, 6, which courses from behind forwards, close outside the carotid artery, and communicates largely with the sympathetic.

Another large central sinus, named *torcular Herophili*, is placed opposite the occipital protuberance, and receives blood from the brain. Opening into it in front is the straight sinus G, (Plate xiii.); above is the superior longitudinal, O; and below is the occipital sinus contained in the *falx cerebelli*. On each side issues the large lateral sinus, which extends to the foramen jugulare, joining there the internal jugular vein, and conveys from the skull the blood both of this and of the cavernous sinus.

#### DISSECTION OF THE ORBIT.

The third stage of the dissection, which is represented on the right side, will be obtained by clearing away the vessels shown in the left orbit in Plate xiii. And the preparation of the last stage, as exhibited on the left side, may be made by removing the lenticular ganglion and the nasal nerve, and by dividing the optic nerve and raising the ends.

#### MUSCLES OF THE ORBIT.

The muscles lying below and to the inner side of the eyeball

act as antagonists to the group of muscles (before described, p. 121) on the outer side and above the ball. Like the other group they consist of two straight and one oblique ; and they are named inferior rectus, internal rectus, and inferior oblique.

N. Upper oblique muscle.  
O. Superior longitudinal sinus.  
P. Levator palpebræ superioris.  
Q. Cavernous sinus.  
R. Upper rectus muscle.

S. External rectus muscle.  
V. Inferior rectus muscle.  
W. Inferior oblique muscle.  
X. Internal rectus muscle.

*Recti muscles.* The lower rectus, V, (depressor oculi) and the inner rectus, X, (adductor oculi) arise, behind, around the optic nerve with the other muscles ; and the two separating from each other in front, are inserted into the eyeball near the cornea, each being attached opposite its antagonist muscle.

One of these muscles contracting, the pupil will be directed towards it, the under rectus depressing and adducting, and the inner one adducting the eye ; but the two recti acting together the pupil will be turned to a point intermediate between both.

The *external rectus*, S, is more evident here than in Figure xiii.; and on the right side the nerves passing between its heads of origin, viz., the third, 3, the nasal nerve of the fifth, 20, and the sixth, 6, have been traced out, to show their relative position.

The *inferior oblique muscle*, W, is displayed only at its insertion into the eyeball. Arising from the fore part of the floor of the orbit, close to the lachrymal sac, it is inclined backwards below the inferior rectus and the eyeball, and is inserted into the back of the eye near the upper oblique muscle.

By the action of this muscle the back of the ball may be depressed and the cornea raised ; and the eye being rotated at the same time the cornea will be directed upwards and outwards towards the temple. This movement towards the outer side of the orbit is thought to counteract the motion of the ball up and in by the upper rectus muscle.

#### DEEP NERVES OF THE ORBIT.

The second nerve, part of the third nerve, the lenticular

ganglion, and the sixth nerve, are met with in the two deeper stages of the dissection of the orbit.

On the right side the lenticular ganglion is depicted, with the optic nerve ; and the other nerves are visible on the left side.

- |   |  |
|---|--|
| 2. Optic nerve.<br>3. Third cranial nerve.<br>4. Fourth nerve.<br>5. Fifth cranial nerve.<br>6. Sixth cranial nerve.<br>13. Gasserian ganglion.<br>20. Nasal nerve at its origin.<br>21. Upper branch of the third nerve. | 22. Lower branch of the third nerve.<br>23. Nasal nerve leaving the orbit.<br>24. Infra-trochlear nerve.<br>25. Lenticular ganglion.<br>26. Long root of the lenticular ganglion to the nasal nerve. |
|---|--|

The *optic* or *second cranial nerve*, 2, lies in the middle of the hollow included by the recti muscles, and enters the back of the eyeball rather internal to the centre : it spreads out in the nervous stratum of the retina. Along it the ciliary arteries and nerves are conveyed to the eyeball.

The *ophthalmic* or *lenticular ganglion*, 25, is a small rather red body, about as large as a pin's head of moderate size, which is situate at the back of the orbit, close to the ophthalmic artery and the optic nerve. Nerves issue from it at four points (angles) : two pass backwards, joining other nerves, and these are called roots ; and several nerves are sent forwards to the eyeball along the optic nerve.

Posterior branches.—A long slender branch—the long root, 26, joins the nasal nerve, 20. Another thick and short branch—the short root, unites with the third nerve, 22, (right side). Sometimes a third offset, between those two, connects the ganglion with the sympathetic.

The anterior branches or the short *ciliary* nerves to the eyeball, are about twelve in number, and form two bundles, upper and lower : they are furnished to the ball, and especially to the muscular structure in it.

The *third cranial nerve*, 3, splits into two as it is about to enter the orbit between the heads of the outer rectus. Its upper piece, 21, ends in the upper rectus, and in the elevator of the upper eyelid.

The lower and larger part of the nerve, 22, (left side) divides into three : one enters the inferior rectus, V; the second belongs to the internal rectus ; and the third offset, 22, (right side) is continued below the eyeball to the inferior oblique muscle. The last branch is joined by the short root of the lenticular ganglion, and supplies through that communication motor nerves to the muscular fibres of the eyeball.

Paralysis of the muscles supplied by the third nerve is attended by dropping of the eyelid, and inability to raise it ; and the eye loses its movements in certain directions. Supposing its existence on one side, the cornea could not be moved vertically, that is to say, it could not be turned upwards or downwards by the elevator and depressor muscles ; it could not be drawn inwards horizontally by the adductor ; nor could it be inclined upwards and outwards by the inferior oblique—all the muscles needful for those movements being supplied by the nerve, and being therefore unable to contract. Only two movements would remain, viz. abduction and rotation downwards and outwards :—the former depending on the external rectus which is supplied by the sixth nerve ; and the latter, on the superior oblique, which receives the fourth nerve.

Double vision will accompany the paralysis when an attempt is made to look with both eyes to the temple of the opposite or healthy side ; and this occurrence is to be accounted for by the loss of the muscular control over the ball of the affected side. In looking with both eyes to the temple (left) in the undiseased state of the muscles, the left eye will be inclined outwards by the external rectus, and the right eye will be turned inwards, towards its fellow, by the internal rectus. But in paralysis, say of the right side, the affected eye cannot be inclined towards its fellow in consequence of the internal rectus having lost its power of contracting, whilst the healthy or left eye will be turned outwards by the external rectus muscle ; and as the axes of the eyes are not kept parallel, images are formed on non-corresponding points of the two retinae, and double vision results.

The *sixth cranial nerve*, 6, enters the orbit between the heads of the external rectus, lying below the third and nasal nerves.



and above the ophthalmic vein: it is distributed to the external rectus muscle.

In paralysis of the external rectus from disease of this nerve the eyeball cannot be directed outwards; and squinting inwards may ensue from the absence of a contracting muscle to balance the internal rectus.

*Orbital branch* of the *upper maxillary* nerve. After the contents of the orbit have been removed, this small nerve may be found in the lower and outer angle, passing through the orbit on its way to the face and the temple.

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## DESCRIPTION OF PLATE XV.

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THIS Figure illustrates the anatomy of the side of the neck behind the sterno-mastoid muscle.

The position of the body indicated in the Drawing will be required also during the dissection, viz. the arm having been drawn down to depress the shoulder, and to make tense the neck muscles.

The more prominent lateral muscles will appear readily on reflecting the skin by the incisions marked in the Plate, and on removing the thin platysma muscle, and the deep cervical fascia; but much time and care will be needed to make clean, and to leave uninjured the deeper nerves and vessels.

### MUSCLES OF THE SIDE OF THE NECK.

All the muscles here exhibited in part, are attached below either to the arch formed by the clavicle and the scapula, or to the first rib; and above they are fixed to the head and the spinal column, with the exception of the omo-hyoid which is attached to the hyoid bone. A hollow, the posterior triangular space, intervenes between the two largest superficial muscles.

A. *Platysma myoides*.  
 B. *Sterno-cleido-mastoid muscle*.  
 C. *Splenius capitis*.  
 D. *Trapezius*.  
 E. *Levator anguli scapulæ*.  
 F. *Scalenus medius*.

G. *Scalenus anticus*.  
 H. *Omo-hyoideus*.  
 K. *Deltoid muscle*.  
 L. *Clavicle*.  
 N. *Pectoralis major*.

*Platysma myoides*, A. This is a membraniform fleshy layer, which is contained in the fatty stratum between the skin and the deep fascia. Arising from the scapular arch, and the top of the thorax and shoulder, it crosses the side of the neck, and is inserted into the base of the lower jaw, blending with muscles of the face.

It covers the external jugular vein, *k*, and the lower two thirds of the posterior triangular space. Its fibres are inclined downwards and backwards from the jaw to the shoulder; and in opening the external jugular vein in venesection the incision is to be so directed as to cut them across.

The *sterno-cleido-mastoid muscle*, B, crosses the neck obliquely from the thorax to the ear. Below, it arises from the first piece of the sternum, and the inner third of the clavicle (Plate xvii.); and it is inserted above into the mastoid portion of the temporal, and the upper curved line of the occipital bone.

From its diagonal position in the neck it separates a triangular hollow in front from another behind: it covers the great carotid blood vessels and the neck muscles, and is crossed by superficial nerves and veins. It is pierced by one large nerve—the spinal accessory or the eleventh cranial nerve, 13.

Both muscles acting, the head will be brought forwards, as in nodding, or the sternum will be raised; according as they may take their fixed point above or below. If only one muscle is used the head is turned to the opposite side; but in combination with other muscles attached to the mastoid process it can incline the head towards the shoulder on the same side.

In wry-neck (*torticollis*) arising from muscular contraction, the sterno-mastoid forms a hard, tense cord on the side of the neck opposite to that to which the head is turned. Subcutaneous cutting through of the muscle has been practised to remove the deformity.

The *trapezius*, D, attached behind to the spinal column and

the head, is inserted in front into the outer third of the clavicle, and into the acromion process and the spine of the scapula.

The anterior free edge of the muscle limits behind the posterior triangular space; it is thin in the upper half, and it is projected forwards, as a point, opposite the fourth cervical nerve and the narrowed part of the neck.\*

The fore part of the trapezius will help the levator anguli scapulæ, E, in raising the shoulder.

*Splenius capitis*, C. This small part of the splenius muscle appears in the posterior triangular space, where it arches forwards from the spinal column to the mastoid process.

Taking its fixed point behind, it can turn the face to its own side; or acting with the sterno-mastoid, it will incline the head to the shoulder. When the muscles of opposite sides act together, the head will be carried backwards.

*Levator anguli scapulæ*, E, occupies the hinder part of the triangular space. It arises from the transverse processes of the three or four upper cervical vertebræ, and is inserted into the base of the scapula (Plate v. C.); its processes of origin may remain separate for some distance as in the Plate, and appear like distinct muscles.

Its ordinary action is manifested in shrugging the shoulders; in this movement it is assisted by the upper part of the trapezius.

The *omo-hyoideus* is a double-bellied muscle, which reaches from the scapula to the hyoid bone, and is tendinous beneath the sterno-mastoideus (Plate xviii.): for the anatomy of the anterior belly, see Plate xvii.

The fibres of the posterior belly, H, are attached beneath the trapezius to the upper border of the scapula, close to the notch in that bone; and they end in front in the intermediate tendon. This belly crosses the posterior triangular space, cutting off a small part below, which contains the subclavian artery; and it is kept in place by a sheath of the cervical fascia.

\* When this edge is represented in Anatomical Plates as straight between the upper and lower attachments, the displaced condition is delineated.

This belly of the muscle makes tense the deep fascia of the neck. The possibility of its compressing the internal jugular vein has been suggested by Theile.\*

The *scaleni muscles*, three on each side, pass from the first two ribs along the side of the spinal column, and are crossed by the great nerves and vessels of the upper limb.

The *anterior muscle*, G, arises from the first rib around a slight prominence on the upper surface ; and it is inserted into the fore part of the transverse processes of four cervical vertebræ, viz. 6, 5, 4, 3.

In front of the muscle lie the omo-hyoideus, H, and sterno-mastoideus, B ; but the deep connections can be more fully observed in Plate xviii. With a lateral view of the side of the neck, as in the Figure, part of the muscle may be seen in the posterior triangular space ; but in a front view, the muscle is usually concealed by the sterno-mastoideus.

The *middle muscle*, F, larger than the preceding, arises from a groove across the hinder part of the upper surface of the first rib ; and it is inserted into the posterior part of the transverse processes of all the cervical vertebræ.

Along its outer edge lies the levator anguli scapulæ ; and it is placed beneath the cervical nerve trunks, and the subclavian artery.

The *posterior muscle* is small, and is concealed by the preceding. Arising from the upper border of the second rib at the back, it is inserted into the transverse processes (posterior or neural) of two or three lower cervical vertebræ.

When the neck is fixed the scaleni will elevate the first two ribs. When the ribs are fixed the movements of the neck will vary with the action of the different muscles. If the two posterior scaleni of one side contract, the neck will be inclined laterally towards the muscles acting ; but if those of both sides come into play at once—the one set antagonizing the other—the vertebral column will remain upright. Should the anterior scaleni of both sides act the neck would be bent forwards, in consequence of their attachment in front of the spine.

\* “Lehre von den Muskeln,” Leipzig, 1841.

Another muscle, the *serratus magnus*, lies in the lower and outer angle of the triangular space, viz., where the omo-hyoideus and the trapezius meet ; it is concealed by the trapezius.

#### POSTERIOR TRIANGULAR SPACE OF THE NECK.

The intermuscular interval on the side of the neck, named the posterior triangular space, is narrow before the fascia is removed, like the corresponding hollows opposite the joints, but in the Drawing the space is delineated as it appears after dissection. The great artery of the upper limb with some smaller branches, and the cervical nerves, together with much fat and interspersed lymphatic glands, are contained in this hollow.

This interval reaches from the clavicle to the back of the head. It is bounded in front by the sterno-mastoideus, B, and behind by the trapezius muscle, D. By its dissection greater apparent length is given to the neck, in consequence of the teguments being removed from part of the head.

Narrower above than below, the space is said to be triangular. Rather it is flask-shaped, with the small part directed upwards. As low as the letter D, the hollow is shallow, and the sides nearly straight ; but beyond that spot it becomes deeper, and is widened in consequence of the posterior border being curved. When in its natural position, the upper part of the sterno-mastoid projects farther back towards the trapezius than is indicated in the Drawing.

Stretched over the space are the skin, the subcutaneous fatty layer containing the platysma, A, and the deep cervical fascia. And the floor of the hollow is formed by the superficial stratum of the muscles of the side of the neck, in the following order. Beginning above, the splenius capitis, C, is first met with ; and below it lies the levator anguli scapulæ, divided into parts and marked by E, E. Farther down comes the scalenus medius, F ; and near the clavicle the serratus magnus projects above the first rib, but this would be visible under the trapezius only in a front-view.

The space is divided into two unequally-sized parts by the small



omo-hyoideus muscle, H—the lower being designated clavicular, and the upper occipital.

The *occipital part*, much the larger of the two, occupies nearly the whole length of the neck. It has the same bounds in front and behind as the large hollow; and it is limited below by the omo-hyoideus, H. Its depth increases towards the lower boundary; and in it are contained chiefly nerves, with some small vessels, and lymphatics.

The *nerves* issue from beneath the sterno-mastoid muscle, and unite in a plexiform manner—the upper nerves entering the cervical, and the lower the brachial plexus.

From the nerves, 1 and 2, of the cervical plexus, superficial branches are directed upwards and downwards:—The ascending set reach the fore part of the neck, the ear and contiguous part of the face, and the back of the head; and the descending set, more numerous than the other, are continued through the space to the integuments of the top of the chest and shoulder.

The lower cervical nerves join in the brachial plexus, 11. These trunks are inclined downwards through the lower end of the occipital part, and through the clavicular part of the triangular space to the axilla: they give few branches, and their position will be referred to again.

One large nerve, 13, the *spinal accessory*, (eleventh cranial nerve) crosses the space obliquely downwards and backwards, from the border of the sterno-mastoideus to the under surface of the trapezius.

*Vessels.* The arterial branches are small in size, and supply the surrounding muscles: they appear behind the sterno-mastoideus. The lowest and largest is the transverse cervical artery, *c*, which passes beneath the trapezius. Veins accompany the arteries, their size corresponding with that of their companions.

The *clavicular part* of the posterior triangular space has its sides formed by the clavicle, L, and the omo-hyoideus, H; and its base or fore part by the sterno-mastoideus, B. Towards the surface it is covered by the same layers as the great triangle; and the floor is constructed by the *scaleni* muscles, the *serratus magnus*, and the first rib.

Larger before than behind, it is placed nearly opposite the middle third of the clavicle. It is about one inch and a half long, and an inch wide in front after the dissection; but until the omo-hyoideus has been displaced, this muscle will lie closer to the clavicle, diminishing thus the width. Contained in it are the subclavian artery, *a*, the brachial plexus, 11, and the external jugular vein, *k*, with their offsets, together with lymphatics and the usual fat.

*Arteries.* The subclavian trunk, *a*, crosses the space from within out. In front it issues from beneath the anterior scalenus, *G*; and it disappears below beneath the clavicle. Along the side of the space formed by the clavicle, the supra-scapular vessels, *b*, lie under cover of that bone. And at the corner where the omo-hyoideus meets the sterno-mastoideus, the transverse cervical vessels, *c*, cross the hollow.

*Veins.* If the subclavian vein is full it may appear beneath the clavicle, though it lies usually at a lower level than the artery. The external jugular vein, *k*, is directed across the space, to join the subclavian vein below: companion veins, *l* and *n*, of the transverse cervical and supra-scapular arteries enter it near the clavicle.

*Nerves.* External to the artery, or higher in the neck than it, the large bundles of nerves entering the brachial plexus are directed downwards in their course to the arm-pit: they have a deep position like the artery, and occupy the interval between the vessel and the omo-hyoid muscle. Near the outer part of the space they approach closer to the vessel, and serve as a valuable guide to it from the constancy of their position, and their white appearance and firm feel. Over the space descend the superficial branches of the cervical plexus: these must be divided in an incision into the neck.

The size of the clavicular part of the triangular space varies much with the condition of the bounding muscles. Alterations in length will be determined by the attachment of the trapezius and sterno-mastoideus to the clavicle, for if one or both should reach farther than usual on that bone, the intermuscular space must be diminished accordingly. The width will be dependent upon the size and the situation of the omo-hyoideus, *H*. When the muscle

is wide, or lies close to the clavicle, the dimensions from above down of the clavicular part of the triangular space will be less than when the muscle is narrow, or is placed at a greater distance from the bone. In some bodies the omo-hyoideus arises from the back of the clavicle, and conceals the subclavian artery, so that there is not any interval in the usual place between the muscle and the collar-bone.

Differences in depth will arise from varying states of the neighbouring parts. In a long and thin neck, with low and flat clavicles, the depth is not so great as in a short and thick neck with prominent and much curved collar-bones. Changes in the position of the shoulder will give rise also to variations in depth. Thus if the shoulder is depressed by drawing down the arm, the space is as shallow as it can be made; whilst raising the shoulder gives to the hollow its greatest depth. And by forcing upwards the shoulder the clavicle can be carried as high as, or even higher than the level of the omo-hyoid muscle and the subclavian artery.

#### ARTERIES IN THE TRIANGULAR SPACE.

In the lower part of the triangular space are contained the trunk of the subclavian artery, and some of its branches. Towards the ear are other small arteries, which are derived from the external carotid trunk.

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|--|--|
| <i>a.</i> Subclavian artery.           | <i>e, f.</i> Branches of the ascending |
| <i>b.</i> Supra-scapular artery.       | cervical artery.                       |
| <i>c.</i> Transverse cervical artery.  | <i>g.</i> Posterior auricular artery.  |
| <i>d.</i> Cutaneous branch of the sub- | <i>h.</i> Cutaneous offset of the pos- |
| clavian.                               | terior auricular.                      |

*Subclavian artery, a.* The third part of the arch of the subclavian trunk (Plate xviii.) lies in the clavicular portion of the posterior triangular space; and it has the following anatomy.

Its extent is marked by the outer edge of the anterior scalenus, G, on the one side, and the lower border of the first rib on the other (below the clavicle). The vessel is directed outwards at first, about an inch above the clavicle, and it passes downwards finally under the most prominent point of that bone.



*Alterations affecting the artery.* Commonly the arch of the vessel rises about an inch above the clavicle (Quain), but it may be lowered to the level of, or sink beneath the bone; and on the other hand it may be elevated as high as one inch and a half above the collar-bone. Occasionally the artery passes over the clavicle through the anterior scalenus, instead of beneath it. When the artery has either the higher level, or the more superficial position, it will be rendered less deep, and will be more easy to find in an operation.

One or two branches for the shoulder, viz., posterior scapular and supra-scapular, may spring from this part of the artery. If such branch or branches should be seen in an operation, great security against secondary hæmorrhage would be obtained by tying one or both, than by leaving either free to convey blood into the arm from the trunk near the ligature.

*Alterations in the surrounding parts.* With a thin and long neck and a flat clavicle, there is a prospect of a less tedious operation than in the opposite states of those parts, because the artery will be nearer the surface.

Muscular fibres may cover the artery as before said, p. 137, the clavicular attachments of the sterno-mastoid and the trapezius being lengthened, or the omo-hyoid arising from the clavicle. Also in axillary aneurism high in the arm-pit the clavicle may be carried upwards considerably above the level of the subclavian artery. Under these circumstances the operation of ligation would be made more difficult, as the artery must be sought behind the raised bone in the one case, and beneath the muscular fibres in the other.

The subclavian vein rises sometimes as high as the level of the clavicle; and it has been found twice beneath the anterior scalenus with the subclavian artery: both changes in its position would cause it to be more endangered in the steps of an operation. The external jugular may be moved outwards from the sterno-mastoid as far as the middle of the clavicle, so that

Mr. Quain's researches on the Surgical Anatomy of the Arteries, in the work before quoted.



trunk and branches would lie in the centre of an incision to reach the artery: this position of the vein may so interfere with the access to the artery as to render expedient division of the vein, and ligature of the ends.

*Steps of the operation of ligature.* Taking the most prominent part of the clavicle as the superficial guide to the position of the artery, draw down the loose skin of the neck, and cut for two inches and a half along the clavicle—the line of the vessel marking the centre of the cut—so as to divide on the bone the skin, the fat and the platysma, and the superficial nerves and vessels.\* Let this cut be next moved rather above the clavicle; and let the operator divide the deep fascia, and find his way vertically downwards to the artery, looking out for the intermuscular interval between the trapezius and sterno-mastoideus, and for that between the omo-hyoideus and clavicle, and incising any muscular fibres which interfere with his progress. After the muscles have been passed the surgeon proceeds cautiously, not letting the knife pass beneath the clavicle to wound the supra-scapular vessels or the subclavian vein, and using at this stage the outer, rather than the inner part of the wound. Towards the inner end of the incision the external jugular vein with branches will soon be met with; and it may be either drawn inwards, or divided and tied, according to the impediment it offers to reaching the artery.

To find the artery in the bottom of the wound, look to the outer end for the firm and white cords of the brachial plexus, which serve as the deep guide; and when these are recognised the artery will be found lower down, *i.e.* between them and the first rib.† After the artery has been laid bare by the removal of some fat and a slight sheath, the aneurism needle should be entered in the outer angle of the wound, where the handle can

\* If such a superficial vessel as that marked *d*, in the Drawing, should rise from the subclavian trunk, division of it at this stage would be followed by considerable hæmorrhage, and ligature of it would probably be needed before the operation could be continued.

† The projection or tubercle on the first rib, at the attachment of the anterior scalenus muscle, is said by some authors to serve as the deep guide to the vessel, but this eminence is seldom prominent enough to be felt by the finger.

be depressed so as to make the point with the thread turn under the vessel.

*Arterial branches.* The smaller arteries laid bare in the dissection are derived from two arterial trunks. Behind the sterno-mastoideus they are offsets of the subclavian or limb artery; and the branches in front of the muscle, or piercing it (except the lowest), spring from the carotid or neck artery.

The *supra-scapular artery, b*, comes from the first part of the subclavian trunk, and runs behind the clavicle with its vein to the upper border of the scapula: it ends on the dorsum of that bone.

An offset from the supra-scapular to the integuments arises near the sterno-mastoid: in this instance it comes from the third part of the subclavian, and is marked *d*.

*Transverse cervical artery, c.* It arises in common with the preceding, and crossing the side of the neck above the arch of the subclavian artery, courses beneath the trapezius: here it furnishes a large branch (superficial cervical), and bends finally along the base of the scapula with the name *posterior scapular*, and supplies the muscles inserted into the vertebral border of that bone.

In the posterior triangle it gives many branches to the levator anguli scapulæ, and to the lymphatic glands and the fat.

Two small arteries, *e* and *f*, are offsets of the *ascending cervical artery* (a branch of the subclavian): they are distributed to the muscles on the side of the neck, and to the areolar tissue and the glands of the triangular space.

The *posterior auricular artery, g*, issues in front of the sterno-mastoideus, and ascends to the back of the ear and the contiguous part of the head.

A cutaneous offset, *h*, courses over the sterno-mastoid muscle and accompanies the small occipital nerve.

*Perforating branches.* After piercing the sterno-mastoid muscle these small arteries supply the platysma and the teguments.

#### SUPERFICIAL VEINS OF THE NECK.

In the neck there are two superficial or jugular veins, a latera

and an anterior. Only the lateral vein and its branches appear in the Drawing : the other is figured in Plate xvi.

*k.* External jugular vein.  
*l.* Transverse cervical vein.

*n.* Supra-scapular vein.  
*o.* A subcutaneous vein.

The *external jugular vein*, *k*, conveys blood from the head to the subclavian vein, and gathers blood also from the superficial parts of the neck. It begins in the parotid gland by the union of the temporal and internal maxillary veins (Plate xvii.) ; and becoming superficial, it descends beneath the platysma muscle, *A*, to the lower part of the neck, where it sinks through the fascia and ends in the subclavian vein (Plate xviii.). Its common position in the neck would be marked by a line from the angle of the jaw to the middle of the clavicle, though in the Plate it is placed internal to that line.

At the upper part of the neck the vein is small in size, receiving only few branches, but for an inch and a half at the lower end, it is dilated behind the sterno-mastoid muscle : here it receives veins from the shoulder, viz. the transverse cervical, *l*, the supra-scapular, *n*, and some cutaneous veins—one being marked with *o*. A pair of valves exists both above and below the lower dilatation. The lower pair is close to the clavicle, and is less complete than the other, for it allows blood to pass in a reflex course from the subclavian vein. The upper pair is found just after the vein crosses the sterno-mastoid muscle, and acts perfectly, as it permits the blood to flow only in one direction—from above down.

Bloodletting in the external jugular vein, is seldom had recourse to now, but the steps of the operation are the following :—The downward current of the blood is stopped by pressure of the thumb near the clavicle. A cut is then made obliquely upwards and backwards across the vein, to incise the vessel and the fibres of the platysma to the necessary extent. As long as the pressure on the vein remains the blood issues through the opening, but when the thumb is removed the flow stops, because the blood finds its way by the usual channel into the subclavian. After the operation is finished the wound is to be closed by adhesive plaster.

Under some conditions air may enter the vein during the operation of bloodletting. As long as the blood runs freely, and the breathing is regular, the accident is not likely to happen : but if the breathing becomes laboured, or if the opening is not closed as soon as the flow of blood stops, air may be drawn into the vein.

In suspended animation the external jugular is sometimes opened with the view of relieving the over-distended right side of the heart\* ; and this practice is founded on the fact that blood will enter the jugular below from the subclavian vein. At the same time the blood can flow downwards through the anterior jugular in the usual way (Plate xviii.), so as to relieve simultaneously the congested heart and head.

#### NERVES IN THE POSTERIOR TRIANGULAR SPACE.

Parts of the cervical and brachial plexuses of nerves, with one cranial nerve—the spinal accessory, are included in the dissection

- |  |   |
|--|---|
| 1. Third cervical nerve.                                   | 9. Branches to the trapezius.                                   |
| 2. Fourth cervical nerve.                                  | 10. Nerve to the subclavius.                                    |
| 3. Great auricular nerve.                                  | 11. Upper part of the brachial plexus.                          |
| 4. Small occipital nerve.                                  | 12. Supra-scapular nerve.                                       |
| 5. Superficial cervical nerve.                             | 13. Spinal accessory nerve.                                     |
| 6. Superficial descending branches of the cervical plexus. | 14. Posterior auricular nerve.                                  |
| 7. Nerve to the rhomboideus.                               | † Nerve to the levator anguli scapulæ from the cervical plexus. |
| 8. Nerve to the serratus magnus.                           |   |

The *cervical plexus* is formed by the union of the upper four cervical nerves ; and it lies beneath the sterno-mastoideus, B, and on the levator anguli scapulæ, E. Only the lower part of the plexus comes into the posterior triangular space, and from it spring muscular, and ascending and descending tegumentary branches.

*Ascending branches.* These consist of the three following nerves, which are directed to the ear, the occiput, and the front part of the neck.

\* A more general employment of this practice is recommended by Dr Struthers, in a paper "On Jugular Venesection in Asphyxia." Edin. Med. Journal for November, 1856.

The *great auricular nerve*, 3, courses near the external jugular vein to the lobe of the ear, and ends in the integuments of the inner and outer parts of the pinna. One offset joins the posterior auricular nerve, 14, and others are directed forwards to the integuments over the parotid gland: some long slender branches pass through the parotid to join the facial nerve (Plate xvii.).

The *small occipital nerve*, 4, lies along the posterior border of the sterno-mastoideus, and perforating the deep cervical fascia near the head, ramifies in the scalp of the occipital region.

The *superficial cervical nerve*, 5, is often represented by several small nerves, as in the Drawing, and is therefore very variable in size: it is distributed to the platysma, and to the integuments of the neck in front of the sterno-mastoid muscle.

*Descending branches.* The chief of these, two or three in number, belong to the teguments of the shoulder and the upper part of the thorax; but some offsets are directed backwards to the integuments over the trapezius muscle, from the clavicle nearly to the head.

A large nerve, 6, divides into three:—one crosses the attachment of the sterno-mastoideus to the clavicle, another lies over the insertion of the trapezius into the same bone, and the third crosses the middle of the clavicle; they extend two or three inches below the collar bone, the inner nerves reaching least far.

*Muscular offsets.* Only a few of these are now visible. One, 7, enters the levator anguli scapulæ. Others, 9, pass beneath the trapezius supplying it; and they join beneath that muscle with the spinal accessory nerve, 13.

*Brachial plexus.*—The lower four cervical nerves, and the first dorsal nerve (in part), give rise to the large bundles of nerves marked, 11; but in the side view presented to the Artist the arrangement of the several nerves entering the plexus could not be shown as in Plate xviii.

The plexus extends under the clavicle to the axilla, where it terminates in nerves for the upper limb; and all the muscular offsets in the neck come from the fifth and sixth cervical nerves, with the exception of small branches to the longus colli and the pectoralis.



The *nerve to the rhomboid muscle*, 7, pierces the fibres of the scalenus medius, and is inclined backwards beneath the elevation of the angle of the scapula.

*Nerve to the serratus magnus*, 8, (posterior thoracic). The nerve issues through the scalenus medius, below the preceding, and is continued beneath the cords of the plexus to the axilla. See Plate ii., 5.

The *nerve to the subclavius*, 10, passes in front of the subclavian artery to the under surface of its muscle.

The *supra-scapular nerve*, 12, accompanies the omohyoid muscle to the back of the scapula, and supplies the supra and infra-spinate muscles, the shoulder-joint, and the blade bone.

The two remaining nerves, which are seen in this part of the neck, belong to the cranial set.

The *spinal accessory nerve*, 13, (eleventh cranial) pierces the sterno-mastoideus, and ends in the trapezius, after crossing the posterior triangular space, where it joins the spinal nerve. Under the trapezius it communicates with the nerve marked, before it enters the fleshy mass.

The *posterior auricular*, 14, a branch of the facial or seventh cranial nerve, ascends in front of the mastoid process, and being joined by the great auricular nerve, splits into two:—one pin belongs to the integuments of the back of the ear, and the retrahent muscle of the pinna; and the other supplies the hind belly of the occipito-frontalis muscle, and the integument contiguous to it.

*Lymphatics.* Beneath the fascia lies a collection of cervical lymphatic glands in the clavicular part of the posterior triangle. They communicate below with the lymphatics of the axilla; above with those about the ear and the occiput, by means of superficial lymphatic vessels and glands accompanying the external jugular vein. Beneath the sterno-mastoideus they join also deep glands by the side of the carotid vessels.

## DESCRIPTION OF PLATE XVI.

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THIS Plate exhibits a surface-view of the side of the neck, in front of a line from the mastoid process to the inner end of the clavicle.

Supposing the skin thrown aside as in the Figure, the thin fleshy fibres of the platysma will appear through a slight fatty covering, and may be readily cleaned. This muscle may be then raised towards the jaw by a cut over the sterno-mastoideus, the superficial veins and nerves being traced out at the same time. Before the removal of the deep fascia the subjacent muscles should be fixed in their natural position by stitches, to prevent their slipping out of place when the investing sheaths are taken away.

Afterwards the areolar tissue and fat are to be cleared out between the jaw and the hyoid bone, and from the whole surface of the space laid bare.

### SURFACE VIEW OF THE FRONT OF THE NECK.

The prominent sterno-mastoid muscle, B, divides into two the side of the neck; and in front of it is a slight hollow, which is most marked near the jaw, and is wider above than below.

In front of the sterno-mastoideus lie the elevator and depressor muscles of the hyoid bone,—the former extending downwards from the lower jaw, and the latter reaching upwards from the chest and shoulder.

Below the side of the jaw is the submaxillary gland, K, with a chain of small lymphatic glands reaching backwards to the sterno-mastoid muscle; and a lymphatic gland, with a small artery entering it, is lodged just above the body of the hyoid bone. Between the jaw and the ear the parotid gland, L, is lodged in.

No large arterial trunk can be seen on the surface of the neck as long as the sterno-mastoideus keeps its natural position ;\* and this Plate teaches also that no triangular space containing the large cervical bloodvessels is observable until that muscle has been displaced, as in Plate xviii.

A few small arteries reach the surface. Thus, the facial artery, *a*, with its vein winds over the submaxillary gland and the jaw in front of the masseter muscle, and gives forwards the submental branch, *b*, below the jaw ; whilst opposite the back of the hyoid bone the lingual vessels, *c*, appear for a short distance. Issuing from beneath the sterno-mastoideus are small cutaneous offsets, *e*, of the upper thyroid artery—one, *d*, entering the superficial lymphatic gland near the hyoid bone ; and piercing the sterno-mastoideus are other cutaneous arteries, *f*, of the subclavian and external carotid trunks. Near the ear a cutaneous branch, *g*, of the posterior auricular artery, escaping beneath the parotid gland, crosses over the sterno-mastoideus.

Two superficial jugular veins are directed from above downwards through the anterior part of the neck. One, the external jugular, *h*, crosses the sterno-mastoideus from before back ; and the other the anterior jugular, *i*, lies in front of that muscle, and near the middle line of the neck.

Cutaneous nerves cross from behind forwards, spreading over the region dissected. The nerve marked, 1, is the cervical part of the seventh cranial nerve, which reaches as low as the hyoid bone ; and the nerve, 2, is a branch of the cervical plexus to the teguments below the preceding.

#### MUSCLES AND THE CERVICAL FASCIA.

Most of the muscles laid bare will be described more fully in the explanation of the following Plate ; but as the natural situation of the sterno-mastoideus, and its connection with the cervical

\* Anatomists depict and describe the common carotid artery as uncovered by the sterno-mastoideus at its upper end. And the directions of surgery for placing a ligature on that bloodvessel are based on the same inaccuracy.

fascia would be destroyed by the deeper dissection, these will be noticed below.

Platysma myoides, cut.  
Sterno-cleido-mastoideus.

Thyro-hyoideus.

Omo-hyoideus.

Sterno-hyoideus.

Anterior belly of the digastric muscle.

Stylo-hyoideus.

J. Hyoid bone.

K. Submaxillary gland.

L. Parotid gland.

N. Process of the deep cervical fascia fixing the sterno-mastoideus.

† Lymphatic glands.

The *sterno-cleido-mastoid* muscle, B, incases somewhat the narrowed part of the neck by the elongation of its edges forwards and backwards. The anterior curved border is manifest in the drawing, and it is kept in this position by a piece of fascia, N, which is attached to the lower jaw.

The muscle covers the carotid bloodvessels as high as the gastric, and even when the head is thrown backwards.

In the operation of tying the common carotid artery the muscle would have to be dissected back for some distance before the line of the vessel is reached; and pressure on the artery must be made through the muscle. This fleshy covering gives protection to the large vessels; and these cannot be injured in wounds of the neck unless the muscle is cut.

*Deep cervical fascia.* The special fascia of the neck invests the muscles with sheaths. Most of it has been removed in cleaning the muscles; but a strong process marked, N, has been left for the purpose of showing its connection on the one hand with the sterno-mastoideus, and on the other with the angle of the lower jaw. The office of this piece is to keep curved the anterior border of the sterno-mastoideus, for as soon as it is cut the edge takes a straight direction, as in Plate xvii.

# CONNECTIONS OF THE SALIVARY GLANDS.

On each side there are three salivary glands in contact with the lower jaw. One is lodged behind the ramus and angle of the jaw, and is named parotid: another is partly covered by the side of the jaw—the submaxillary; and the third, the sublingual, lies beneath the front of the tongue.

The *parotid* is the largest of the salivary glands. It is placed between the jaw in front, and the ear with the mastoid process and the sterno-mastoideus behind ; and it projects downwards beyond the level of the jaw, where the process, N, of the cervical fascia separates it from the submaxillary gland.

Towards the surface the gland is flat, and is covered by the deep cervical fascia : on it rest one or more lymphatic glands. Its deep part is very irregular in form, and sends downwards prolongations around the styloid process.

Several vessels and nerves pass through the substance of the parotid, and the position of these may be studied in Plate xv. The external carotid artery, *b*, ascends through the gland giving off the auricular, temporal, and internal maxillary branches. The external jugular vein, *r*, begins by the union of the temporal and internal maxillary branches, and passes downwards superficially to the carotid. The facial nerve, 4, traverses the gland from behind forwards, over the artery, and is joined by offsets of the great auricular nerve. Close to the ear the cutaneous part, 1, of the auriculo-temporal nerve is directed upwards by the side of the temporal artery.

The excretory duct of the gland (ductus Stenonis) leaves the fore part, and piercing the buccinator muscle, opens into the mouth opposite the second molar tooth of the upper jaw (Plate xx.).

In enlargement of this gland the swelling will project downwards at first towards the deep vessels and nerves in front of the spine, and then into the neck along the sterno-mastoideus ; but extension towards the surface will be delayed by the strong fascia binding it down. Much pain will attend the swelling of the gland in "mumps" and other affections, just as in all inflammatory glandular parts that are prevented expanding by the firmness of the incasing sheaths.

The swelling and abscesses in front of the ear in scrofulous children are occasioned by inflammation of the lymphatic glands on the surface of the parotid.

The *submaxillary gland*, K, is not surrounded by such unyielding structures as the parotid ; for, though concealed somewhat



On the side of the maxilla, it projects down the neck for an inch or more in front of the angle of the jaw. Superficial to it are the integuments and the platysma with the deep fascia; and beneath is the mylo-hyoid muscle. In front it is bounded by the anterior belly of the digastric, F; below by the digastric and the stylo-hyoid, H; and behind by the process, N, of the deep cervical fascia which intervenes between it and the parotid. Over the surface wind the facial vessels, *a*.

The gland consists of larger lobules than the parotid; and from its deeper surface the duct (Wharton's) is continued to the floor of the mouth: the course of the duct is evident in Plate xxii. of the submaxillary region.

The *sublingual gland* projects in the floor of the mouth under the front of the tongue, where it forms a lengthened swelling. Placed deeply under the side of the jaw, close to the symphysis, its connections will be indicated in Plate xxii.

The *lymphatic glands* marked thus, †, are three or four in number, and lie along the base of the jaw, superficial to the submaxillary gland: they receive vessels from the submental artery, *b*. In scrofulous children these glands may enlarge, and suppurate.

In the middle line, just above the hyoid bone, is a small lymphatic gland, which receives a vessel, *d*, from the upper thyroid artery.

#### SUPERFICIAL ARTERIES OF THE NECK.

In comparison with the superficial veins the arteries appearing on the surface are few, and are small in size. None except the facial, *a*, and the lingual, *c*, are large enough to furnish serious hemorrhage in superficial wounds; but in cuts involving the muscles, the large trunks displayed in Plate xvii. may be opened.

Facial artery and vein.  
Submental branch of the facial.  
Lingual artery and vein.  
Offset of the upper thyroid artery  
to a lymphatic gland.

*cc.* Superficial offsets of the upper thyroid artery.  
*ff.* Branches of the subclavian and carotid trunks perforating the sterno-mastoideus.  
*g.* Cutaneous offset of the posterior auricular.

The anatomy of the several arteries will be given with the description of Plate xvii.

### SUPERFICIAL VEINS OF THE NECK.

Two superficial jugular veins, and the facial and lingual veins appear in this dissection.

*h.* External jugular vein.

*l.* Anterior jugular vein.

*n.* Facial vein.

The *external jugular* vein, *h*, is figured in the part of its course which is superficial to the deep fascia of the neck, and is concealed by the platysma muscle, A, (p. 143).

The *anterior jugular* vein, *l*, begins in the teguments below the chin, and communicates with a branch of the facial vein. Lying superficially near the anterior edge of the sterno-mastoideus, it sinks through the cervical fascia near the sternum, and opens into the subclavian vein (Plate xviii.). It unites commonly by a branch with the external jugular.

### CUTANEOUS NERVES OF THE FRONT OF THE NECK.

The facial nerve and branches of the cervical plexus supply the superficial structures of the neck.

1. Cervical part of the facial nerve.

2. Superficial cervical nerve.

3. Great auricular nerve.

The *infra-maxillary* branch, 1, of the facial nerve, issuing from beneath the parotid, sends forwards offsets beneath the platysma as low as the hyoid bone: it supplies that muscle and the integuments.

The *superficial cervical nerve*, 2, is bent forwards under the platysma, and its branches pierce the muscle to supply the integuments between the hyoid bone and the sternum. Above, it joins the facial nerve: and it is said to give offsets to the lower part of the platysma.

The *great auricular nerve*, 3, ascends by the side of the external jugular vein to the ear, and ends as before said (p. 145).

## DESCRIPTION OF PLATE XVII.

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THE anterior triangular space of the neck, as it appears after displacement of the sterno-mastoid muscle, is shown in this Figure.

Whilst the skin is being reflected forwards, the platysma muscle may be denuded; and this muscle and the deep cervical fascia should be then raised. Afterwards the parotid gland is to be picked out of the hollow between the ear and the jaw, and the areolar tissue and the fat are to be removed from the space, as is seen in the Drawing, without injury to the numerous vessels and nerves.

### ANTERIOR TRIANGULAR SPACE.

This intermuscular space corresponds with the surface-depression between the jaw and the sternum, and contains the carotid bloodvessels with their companion veins and nerves, and some salivary and lymphatic glands.

Triangular in form, with the base upwards, it is bounded in the following way. Behind is the reflected sterno-mastoideus with the ear; and in front the space reaches to the middle line of the neck. At the base lies the jaw-bone; and the apex touches the top of the sternum.

Stretched over the hollow are the teguments, with the platysma muscle and the deep cervical fascia; and in the floor the air and food passages are lodged, covered by the muscles of deglutition.

The depth increases from below upwards; and it is greatest along the upper two thirds of the sterno-mastoideus and the front of the ear, where the great vessels and nerves are placed, but it diminishes gradually towards the front.

Along the middle of the neck lie certain well-marked prominences, which can be felt readily by the finger during life, and serve as guides in operations on the vessels and the windpipe. About two inches from the lower jaw, when this is raised, projects

the narrow firm line of the hyoid bone, which is marked J, in the preceding Plate. A finger's breadth below that bone the prominence of the thyroid cartilage of the larynx (pomum Adami) is met with. Still lower, about half an inch, comes the firm cricoid or ring cartilage of the larynx,—a prominence less than the former, and between the two is a slight hollow, opposite the crico-thyroid membrane, through which the knife is sunk in the operation of laryngotomy. From this point to the sternum the tube of the windpipe and the thyroid body carry forwards the muscles: the former can be recognised by the finger.

Behind the os hyoides and the larynx and trachea lies the pharynx with the œsophagus.

*Position of arteries.* Opposite the level of the cricoid cartilage the large trunk of the common carotid, *a*, escapes from beneath the depressor muscles of the hyoid bone. In company with the internal jugular vein it lies between the pharynx and the spine, and ascends under cover of the sterno-mastoideus, A, to the upper border of the thyroid cartilage, where it splits into the external carotid, *b*, and internal carotid, *c*. From the point of division these two arteries are continued in the direction of the parent trunk to the interval between the ear and the jaw, and they end in the following way:—one (external) is consumed in offsets outside the cavity of the skull; and the other (internal) is distributed chiefly to the brain, without furnishing branches to the neck. Neither vessel is visible till after the sterno-mastoideus has been displaced. See Plate xvi.

*Position of veins.* By the side of the common carotid artery lies the internal jugular vein, *p*; and it is continued to the base of the skull along the internal carotid trunk. In the upper narrow part of the space between the jaw and the ear the external jugular vein begins; but it then runs downwards over the sterno-mastoideus. Near the middle line of the neck the anterior jugular vein, *s*, descends (Plate xvi.); and it passes beneath the sterno-mastoideus at the lower part of the neck.

*Position of nerves.* Many nerve trunks lie in contact with the great bloodvessels, and most of them accompany those vessels to the base of the skull.

Superficial to the sheath of the vessels where the common carotid may be tied, is the descendens noni nerve, 3. A little above the hyoid bone the hypoglossal nerve, 14, is directed forwards over both carotid arteries; and in front of the ear the branches of the facial nerve, 4, cross over the external carotid.

On a line with the base of the jaw-bone the glosso-pharyngeal nerve is inclined inwards between both arteries.

In the sheath, between and parallel with the vein and artery, the vagus nerve extends through the neck (Plate xxiv.); two of its branches, the superior laryngeal, 1, and the external laryngeal, 2, being directed inwards to the larynx.

Beneath the sheath the cord of the sympathetic nerve (Plate xxiv.) rests on the spinal column.

External or posterior to the sheath for a short distance is the spinal accessory nerve, 13, as this issues from beneath the digastric muscle, R.

One small nerve is altogether removed from the sheath: it is the mylo-hyoid branch, 12, of the inferior maxillary nerve (Plate xxi.), and escapes from under the jaw-bone.

*Glands of the space.* Two large salivary glands, the parotid and submaxillary, which are seen in Plate xvi., where they are marked L and R, occupy the base of the triangular space.

The lymphatic glands have been cleared away in the dissection: one set lies along the jaw-bone (Plate xvi.); and the other (deep cervical) is placed along the side of the jugular vein, under the sterno-mastoideus.

#### MUSCLES OF THE FRONT OF THE NECK.

The muscles occupying the upper and fore parts of the triangular space converge to the os hyoides—the upper set elevating, and the lower set depressing that bone.

- A. Sterno-mastoideus.
- B. Stylo-hyoideus.
- C. Omo-hyoideus—anterior belly.
- D. Sterno-thyroideus.
- E. Thyro-hyoideus.

- H. Digastricus—anterior belly.
- N. Hyo-glossus.
- P. Stylo-hyoideus.
- R. Digastricus—posterior belly.
- S. Masseter.



*Depressors of the os hyoides.* These muscles cover the trachea and larynx, and are marked B, C, and D.

*Omo-hyoideus, C.* The anterior belly of this muscle crosses the common carotid artery and jugular vein just below the cricoid cartilage, and is inserted into the body of the hyoid bone close to the great cornu. For the posterior belly, see Plate xv. and p. 133.

*Sterno-hyoideus, B.* The muscle arises from the inner surface of the sternum and first rib, and is inserted into the middle of the body of the hyoid bone.

*Sterno-thyroideus, D,* arises lower in the chest than the preceding, though like it from the sternum and the rib, and is inserted into the oblique line on the thyroid cartilage, where it is continuous with the following.

The small *thyro-hyoideus, F,* joining the preceding below, is inserted into the anterior half of the great cornu, and into part of the body of the os hyoides.

This group of muscles is covered partly by the sternomastoides; and it conceals the windpipe and the thyroid body, and the sheath of the great bloodvessels. An interval separates the muscles of opposite sides along the middle line of the neck, except for about an inch above the sternum, where the sternothyroideus muscles touch.

*Action.* Commonly the muscles act from the sternum, and draw down rapidly the os hyoides as soon as the morsel of food and the fluid to be swallowed has passed the upper aperture of the larynx. If they take their fixed point above, the sternohyoideus and sternothyroid will assist in dilating the chest in laborious breathing; and the small thyro-hyoid, F, will raise and tilt backwards the thyroid cartilage—relaxing thereby the vocal cords.

*Elevators of the hyoid bone.* These muscles are more numerous than their antagonists, for some extrinsic muscles of the tongue help to raise the os hyoides: the deeper muscles of the set may be referred to in Plate xxii.

*Stylo-hyoideus, P.* Arising near the root of the styloid process, the muscle is divided into two parts, between which passes the tendon of the posterior belly, R, of the digastricus; and it

inserted into the body or the great cornu of the os hyoides, joining the aponeurosis of the digastricus.

The *digastric* muscle consists of two fleshy parts with an intermediate tendon.

The posterior belly, R, is fixed to the groove beneath the mastoid process of the temporal bone; and the anterior, H, is attached to the jaw close to the symphysis. Below, the muscle is connected to the surface of the body of the hyoid bone by a thin aponeurosis, which joins the anterior belly and the fore part of the tendon.\*

The digastric encloses with the jaw a space in which the two superficial salivary glands are lodged. And the posterior belly marks the spot at which the carotid bloodvessels become deep and inaccessible: the position of this part of the muscle corresponds with a line on the surface from the mastoid process to a point half an inch above the hyoid bone.

The *mylo-hyoid* muscle descends from the jaw-bone to the body of the os hyoides: it lies beneath the anterior belly of the digastric, and in Plate xxii., where it is reflected, it may be seen to join its fellow along the middle line of the neck.

The *genio-hyoideus* is beneath the preceding. Plate xxii. shows it in position, reaching from the jaw to the hyoid bone.

Two tongue muscles—*hyo* and *genio-glossus*—may act as elevators of the hyoid bone: the *hyo-glossus* is marked with N in the Figure, and both are displayed fully in Plate xxii.

*Action of the elevators.* With the mouth shut and the tongue fixed against the roof, the muscles will assist in preparing the pharynx for the reception of the food, by drawing upwards and forwards the os hyoides, so as to bring the larynx under shelter of the tongue. But if the mouth is open and the tongue not in contact with the roof, the muscles are deprived of their usual point of support above, and swallowing will be performed with difficulty;—the necessary elevation of the hyoid bone in this imperfect deglutition being then dependent upon the *stylo-hyoideus* and

\* There are great variations with respect to this attachment and the state of the *stylo-hyoideus* muscle: some of these may be perceived in the different Plates.

posterior belly of the digastricus, which retain their usual position, and on the extreme contraction of the other muscles.

Supposing the os hyoides fixed by its depressors, the muscles used commonly as elevators of that bone will have a different action:—those attached to the jaw may then carry it downwards so as to open the mouth; and the lingual muscles can depress the tongue.

#### ARTERIES OF THE FRONT OF THE NECK.

Only the carotid trunks and some branches of the external carotid artery are visible in front of the sterno-mastoideus.

- a.* Common carotid artery.
- b.* External carotid artery.
- c.* Internal carotid artery.
- d.* Superior thyroid artery.
- e.* Lingual artery.
- f.* Facial artery.

- g.* Occipital artery.
- h.* Posterior auricular artery.
- i.* Superficial temporal artery.
- n.* Internal maxillary artery.
- × Spot for ligature of the common carotid artery.

The *common carotid* trunk, *a*, begins opposite the sterno-clavicular articulation, and ends at the upper edge of the thyroid cartilage by splitting into two—external and internal carotid. Its situation will be marked on the surface by a line from the inner end of the clavicle to a point midway between the jaw and the ear.

Contained in a sheath of fascia with the jugular vein and the vagus nerve, it is covered throughout by muscles; and it has the following connections with the contiguous parts:—Superficial to it, besides the teguments and the platysma, are the depressors of the hyoid bone and the sterno-mastoideus—the last muscle covering it to the ending (Plate xvi.); and the others, only as high as the cricoid cartilage. Beneath the vessel is the spinal column. To its inner side lie the gullet and the air passage, with the thyroid body; and as the trachea swells out to form the larynx, necessarily the artery is carried farther from its fellow above than below. Along the outer side is a chain of lymphatic glands which is liable to become enlarged.

The internal jugular vein, *p*, is parallel to, and in close contact

externally with the artery; and on the left side the vein advances over it, especially lower in the neck. Three veins cross the artery;—near the chest is the anterior jugular vein, *s*; near the dividing the upper thyroid vein; and below, *x*, the middle thyroid vein.

In front of the sheath, in the upper half, the descendens noni nerve, 3, crosses obliquely from without inwards. Beneath the sheath is the sympathetic nerve; and lower down the recurrent laryngeal nerve and inferior thyroid artery cross inwards under it. In the sheath, between the artery and vein lies the vagus nerve.

No collateral offset arises commonly from the carotid artery, and the trunk remains nearly of the same size; but not unfrequently the upper thyroid branch *d* is transferred to the slight dilatation at the end.

*Ligature of the vessel.* The part of the common carotid marked thus *x* is selected for ligature because it is far removed from each end, and because it is less deep here than at a lower point. But since the vessel may bifurcate as low as the cricoid cartilage or even lower, two trunks instead of one may be met with at this spot. Should the point of splitting of the artery be recognised in the operation of ligature both trunks may be tied; but if the origin of the two trunks cannot be seen in consequence of the artery having divided very soon, the finger may be pressed on each, and that trunk may be tied which takes blood to the disease or injury for which the operation was undertaken (Quain).

*Steps of the operation.* With the line of the vessel in mind, the operator places the forefinger of the left hand opposite the cricoid cartilage, and makes an incision in that line three inches in length (the finger marking the centre) through the integuments, platysma, and deep fascia, down to the fibres of the sternomastoideus: should the cut be made too far forwards, the anterior jugular vein may be injured. Next the sterno-mastoid muscle is to be dissected back rather beyond the position of the artery, the head being inclined towards the shoulder of the same side to relax its fibres. The operator now looks for the deep guide, viz., the angle formed below by the omohyoid muscle, *C*, and the sternomastoideus, *A*, and seeks the vessel at that spot, dissecting but

very little, because the descendens noni nerve, 3, and offsets of the upper thyroid vessels to the sterno-mastoideus cross the sheath.

The sheath is next to be opened towards the inner part—over the artery—avoiding the nerve, and the small vessels if possible; and after the artery has been separated from its sheath the needle is to be passed under it, whilst the opposite side of the sheath is raised with a pair of forceps. Between the artery and vein lies the vagus nerve: this is not to be included in the ligature, and if the artery has been carefully detached the nerve cannot well be caught. Before tying the thread the operator should ascertain that the pulsation in the vessel can be stopped by pressure.

Should the artery be denuded too much, the application of two ligatures may be needful—one at each end of the part laid bare. And should the size of the vein be inconveniently large, it may be diminished by the pressure of the finger of an assistant at the upper part of the wound.

In an operation on the left side the vein, from its position over the artery, would have to be turned aside; and this step may be needed also on the right side when the vein covers the artery.

In the operation on the dead body the needle will pierce readily the coats of a large loose artery, if force is used; and any check therefore to the progress of the needle in the living body should be met by drawing back the point of the instrument, and by pulling upwards tightly with a forceps the opposite side of the sheath before another attempt is made to pass the ligature.

The *internal carotid* artery, *c*, is the direct continuation of the common carotid trunk, and enters the skull through the temporal bone (Plate xxiv.). Below the level of the digastric muscle the artery may be reached by the surgeon, but above that muscle it is quite inaccessible. No offset is given from this vessel in the neck.

In the accessible part of its course it corresponds with the surface-line of the common carotid. It is covered, like the vessel, by the sterno-mastoideus, and rests on the spine;—at this spot it lies external or posterior to the external carotid trunk. The internal jugular vein, and the vagus and sympathetic nerve



have the same position to the internal, as to the common carotid artery.

Crossing the artery superficially is the hypoglossal nerve, 14, which sends down the descendens noni branch, 3; and beneath the superior laryngeal nerve, 1, is directed inwards. The occipital artery, *g*, runs backwards over it, commonly near the digastric muscle, but sometimes lower down as in the Figure: a branch of this supplies the sterno-mastoideus.

*Ligature.* If this artery is ever tied it should be secured as far from its origin as it well can be; and a point between the hyoid bone and the digastric muscle may be selected as the most suitable. But the part of the artery available may be very short in consequence of the common carotid ascending as far as, or farther than the os hyoides before it splits. Should the forked ending of the common trunk be found in an operation, both the resulting arteries may be secured at their origin. Occasionally the ending of the common carotid rises still nearer to the head, and in those cases no part of the internal carotid will be below the digastric muscle.

The spot for the application of the ligature being well ascertained by means of the digastric muscle, the hyoid bone, and the line of the artery, the first steps of the operation, and the parts to be cut through are the same as those before given for ligature of the common carotid. After the sterno-mastoid muscle has been reflected the hypoglossal nerve and the occipital artery, with their branches, may be met with. When laying bare the artery care must be taken of the external carotid trunk on the one side, and of the internal jugular vein on the other; and in passing the aneurism needle the same precautions are to be observed as in the case of the common carotid (p. 159).

The *external carotid* artery, *b*, reaches from the upper border of the thyroid cartilage nearly to the neck of the lower jaw, and ends by dividing into temporal and maxillary branches. It is smaller than the internal carotid; and it distributes branches to the neck, and the outer parts of the head. At first it is placed on the anterior or inner side of the internal carotid, but afterwards becomes superficial to that vessel.

As high as the mastoid process the artery is covered by sterno-mastoideus, A, the digastricus, R, and the stylo-hyoid P, besides the common investing superficial layers; and the to its ending it is concealed by the parotid gland (Plate xv). Anterior to it are the pharynx and the jaw; and beneath is the styloid process. No companion vein belongs to the artery.

Several nerves cross this carotid trunk:—superficial to it from the beginning is the hypoglossal nerve, 14, and near the end the ramifications of the facial nerve, 4; whilst beneath it the external laryngeal, 2, the superior laryngeal, 1, and near the jaw the glosso-pharyngeal (Plate xxii.).

The offsets of the artery are numerous:—they consist of an anterior set of three, viz., thyroid, *d*, lingual, *e*, and facial, *f*; a posterior set of two, occipital, *g*, and posterior auricular, *h*; and an ascending set, also three in number, the temporal, *l*, internal maxillary, *n*, and ascending pharyngeal (Plate xxiv.).

*Ligature.* The artery is accessible below the digastric muscle and here it is covered, like the internal carotid, by the sterno-mastoideus. Its branches are attached to the trunk so thickly as not to leave space enough between any two for the application of a ligature without the prospect of hæmorrhage when the thread comes away. Before the removal of tumours about the jaw, ligature of the external carotid trunk might be considered advisable as an auxiliary means of checking hæmorrhage during an operation.

In a wound of a branch of the external carotid the vein should be tied, as a rule, where it is injured; but in hæmorrhage from the artery of the tongue, where the bleeding orifice can be secured, the surgeon may have recourse to ligature of the artery nearer the origin from the common trunk.

*Branches of the carotid.* The *upper thyroid*, *d*, ends in the thyroid body: it gives offsets to the contiguous muscles, and a laryngeal branch to the interior of the larynx with the upper laryngeal nerve, 1.

The *lingual* artery, *f*, is distributed to the tongue. Above or below the cornu of the hyoid bone it is directed into

beneath the hyo-glossus muscle, N. In the tongue the arteries of opposite sides converge to the tip (Plate xxii.).

If this artery is to be tied it may be secured between the origin and the edge of the hyo-glossus muscle, as it passes near the cornu of the hyoid bone. An incision directed downwards and backwards over the cornu of the os hyoides would allow the artery to be laid bare: the hypoglossal nerve is a valuable guide to the position of the vessel in the bottom of the wound.

The *facial* artery, *f*, comes off near the digastricus, and courses under it and the stylo-hyoideus, but over the submaxillary gland. It supplies branches to the surrounding parts, and a *submental* offset below the jaw.

As it crosses the jaw it lies in front of the masseter, where it is covered by the platysma: it can be easily compressed with the finger in that situation.

The *occipital* artery, *g*, begins near the digastric muscle, and is directed beneath it to the occiput: the hypoglossal nerve hooks round the vessel when this arises low down. One or more offsets enter the sterno-mastoideus.

The *posterior auricular*, *h*, springs near the upper border of the digastricus, and runs to the back of the ear. A cutaneous offset passes to the occiput.

*Temporal* and *internal maxillary*. The maxillary, *n*, courses beneath the jaw; and it will be met with in other dissections. The temporal, *l*, ascends to the side of the head, and gives offsets to the ear: anteriorly it supplies a large branch to the face—the *transverse facial*.

#### VEINS OF THE FRONT OF THE NECK.

Three in number, the veins are named jugular—internal, external, and anterior; and they return to the chest the blood circulated through the head and neck by the carotid arteries.

*p*. Internal jugular vein.  
*r*. External jugular vein.

| *s*. Anterior jugular vein.

The *internal jugular* vein, *p*, reaches from the foramen jugulare

in the base of the skull to the inner end of the clavicle, where it joins the subclavian vein (Plate xviii.). In the neck it is the companion vein to the common, and the internal carotid artery, and it is joined by the veins corresponding with the branches of the external carotid, with the exception of three which enter the external jugular.

*External jugular, r.* The course and ending of this vein have been before described (p. 143). In the Drawing the beginning of the vein by the union of the temporal and internal maxillary veins may be perceived : into the vein the posterior auricular branch of the external carotid is received lower down.

#### NERVES OF THE FRONT OF THE NECK.

Several cranial nerves appear in the region dissected ; and they are distributed to the face, the tongue, the windpipe, and the gullet. Only one spinal nerve is seen.

- |  |  |
|--|--|
| 1. Upper laryngeal nerve.                          | 8. Posterior auricular nerve.                                |
| 2. External laryngeal nerve.                       | 9. Branches of the great auricular nerve joining the facial. |
| 3. Descendens noni nerve.                          | 10. Great auricular nerve.                                   |
| 4. Facial nerve.                                   | 11. Auriculo-temporal branch of the fifth nerve.             |
| 5. Temporo-facial piece of the facial nerve.       | 12. Mylo-hyoid branch of the fifth nerve.                    |
| 6. Cervico-facial piece of the facial nerve.       | 13. Spinal accessory nerve.                                  |
| 7. Nerve to the digastric and stylo-hyoid muscles. | 14. Hypoglossal nerve.                                       |

The *facial* nerve, 4, issuing from the skull by the stylo-mastoid foramen, divides into two chief parts,—temporo-facial, 5, cervico-facial, 6 : these pass forwards through the parotid gland to the forehead, the face, and the superficial parts of the neck as low as the hyoid bone.

As soon as the nerve leaves its bony canal it gives off the posterior auricular nerve, 8, and a muscular branch, 7, to the posterior belly of the digastricus and to the stylo-hyoideus.

It is chiefly a motor nerve ; and it gives the ability to contract the superficial muscles of the head, ear, face, and neck.

joins freely with the sensory fifth nerve, and furnishes offsets so to the integuments; and as it supplies alone the posterior belly of the digastricus and the stylo-hyoideus, it must confer on them sensibility as well as motion.

The *hypoglossal* nerve, 14, is a motor nerve of the tongue. Descending through the neck with the great bloodvessels till it comes below the digastric muscle, it is then directed forwards over the carotids to the submaxillary region: it will be continued Plate xxii.

As it crosses the vessels it supplies two offsets:—one, *descendens mi*, 3, enters the depressor muscles of the hyoid bone, after joining with the spinal nerves (Plate xxiv.); the other, much smaller, ends in the thyro-hyoideus, F.

*Branches of the vagus.* Two branches of this nerve, viz., the upper laryngeal, 1, and the external laryngeal, 2, (an offset of the first) are furnished to the larynx; their distribution will be referred to more fully in the description of the Plate of the larynx.

*Branches of the fifth nerve.* The *auriculo-temporal*, 11, is a sensory nerve, and ascends with the temporal artery to the side and top of the head: it supplies the ear with the attrahent muscle, and the parotid gland. The *mylo-hyoid* branch, 12, lies below the jaw, and ends in the anterior belly of the digastricus, and the mylo-hyoideus: contractility and sensibility are given to those muscles by the nerve.

The *great auricular* nerve, 10, of the cervical plexus is displayed in Plate xvi. In this Figure the communicating branches, through the parotid to the facial nerve are brought into view.



## DESCRIPTION OF PLATE XVIII.

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THE dissection of the subclavian bloodvessels with the contiguous nerves and muscles is portrayed in this Plate.

This view has been obtained by cutting through the sterno-mastoid muscle, after the dissection of the posterior triangular space; and by sawing through the clavicle and removing the inner end. On the section of the clavicle the shoulder falls back and the subclavius and omo-hyoideus muscles are stretched.

### MUSCLES OF THE SUBCLAVIAN REGION.

Only the subclavius, the posterior belly of the omo-hyoideus and the anterior scalenus will be now referred to, the other muscles having been described in other dissections.

- |  |  |
|--|--|
| A. Pectoralis major, cut.                  | H. Sterno-thyroideus.                      |
| B. Intercostal muscles of the first space. | J. Sternal part of the sterno-mastoid.     |
| C. Subclavius muscle.                      | K. Clavicular part of sterno-mastoid, cut. |
| D. Omo-hyoideus-posterior belly.           | L. Anterior scalenus.                      |
| E. Omo-hyoideus-anterior belly.            | N. Middle scalenus.                        |
| G. Sterno-hyoideus.                        |  |

*Anterior scalenus*, L. The connections of the muscle may here be studied: the attachments are given at p. 134. It lies beneath the sterno-mastoid and omo-hyoid muscles; and it is connected with the following vessels and nerves. In front of it lies the subclavian vein, *p*, with the external jugular, *s*, and the anterior jugular, *v*; and along the inner edge descends the large internal jugular vein, *r*. Beneath it is the subclavian artery, *b*; and on it are three small arteries, supra-scapular, *h*, and ascending cervical, *f*. Issuing from beneath the muscle are the large cervical nerves; and running down in front of it is the phrenic nerve, *3*.

*Omo-hyoideus*, B. The posterior belly of this muscle is attached behind to the upper border of the scapula, and ends in front in a tendon beneath the sterno-mastoideus. It receives a small vessel from the supra-scapular, and a nerve from the descendens omi; and the supra-scapular vessels, *l* and *w*, and the supra-scapular nerve, 9, course backwards with it. See also Plate xv., and p. 133.

*Subclavius muscle*, C. In Plate ii. this may be viewed in its natural state, surrounded by a sheath of fascia. It arises from the first rib where the bone and cartilage join; and it is inserted to the grooved under surface of the clavicle. The inner part of the muscle shows a ragged edge, where it was detached from the bone.

#### THE SUBCLAVIAN ARTERY AND ITS BRANCHES.

The subclavian artery runs through the lower part of the neck, and gives branches to the chest, the shoulder, the neck, and the brain.

First part of the subclavian trunk.

Third part of the subclavian.

Common carotid artery.

Inferior thyroid artery.

*f*. Ascending cervical artery.

*h*. Transverse cervical artery.

*l*. Supra-scapular artery.

*n*. Internal mammary artery.

The *subclavian* artery of the right side begins opposite the inner end of the clavicle, where the innominate trunk bifurcates, and ends at the lower border of the first rib by becoming axillary. Between those points the artery forms an arch with the convexity upwards, which lies between the scaleni muscles. Its numerous connections will be best learnt by dividing the trunk of the artery into three parts:—one inside, one beneath, and one outside the anterior scalenus.

The *first part* of the artery, *a*, is concealed by the muscles of the front of the neck, viz., sterno-mastoideus, J, sterno-hyoideus, G, and sterno-thyroideus, H; also by the integuments and the platysma. It lies deeply, but not in contact with the spinal column.

Lying near the chest and below the artery is the arch of the

subclavian and innominate veins ; and crossing it at right angles is the internal jugular vein, *r*, with the vertebral vein beneath this. And in front of the artery though separated by muscles is the anterior jugular vein, *v*.

The vagus nerve, 10, crosses over the artery inside the jugular vein, together with some branches of the sympathetic ; and the recurrent branch of the vagus, and the cord of the sympathetic lie beneath it (Plate xxiv.).

The *second* or *middle part* of the artery, the shortest and highest is covered by the anterior scalenus, *L*, and the sterno-mastoideus *K* ; and rests on the middle scalenus, *N*.

No vein touches the artery in the second part, for the anterior scalenus intervenes between the subclavian vein and artery. Two arteries, transverse cervical, *h*, and supra-scapular, *l*, lie near the line of the subclavian trunk, the former being rather above, and the latter below it.

The lower cervical nerves are above the vessel between the scaleni ; and the phrenic, 3, crosses it, but separated by the scalenus anticus.

The *outer* or *third part*, *b*, is the most superficial, and descends over the first rib to the axillary space, crossing beneath the omohyoideus, *D*, the subclavius, *C*, and the clavicle. This part appears in the posterior triangular space of the neck (Plate xv.) and its connections are described in p. 137.

Into the concavity of the arch of the bloodvessel the bag of the pleura projects, for this membrane rises above the first rib, and comes in contact with the first and second parts of the subclavian artery : this connection of the serous membrane must be remembered when ligature of the second part of the artery is to be undertaken. Alterations affecting the arch have been dwelt on in p. 140.

*Number and position of the branches.* Usually four branches arise from the artery in the following manner :—three are connected with the first part, and one with the second part ; whilst no branch, as a rule, comes from the third part. Very commonly however (Quain) an offset (posterior scapular) of the branch, *h*, is attached to the last part of the subclavian trunk.

From the position of the branches, the connections, and the difference in the depth of the ends of the subclavian trunk, the third or external part, *b*, will be best suited for ligature on account of its comparative freedom from any branch, and its easily accessible position. As the second part gives origin commonly to but one branch it may admit of being tied under some circumstances. Whilst the inner or first part is so beset by branches as not to possess commonly an interval sufficient for the application of a ligature without secondary hemorrhage. On the left side the complicated connections forbid the attempt to put a thread on the first part.

*Ligature.* The steps of the operation for securing the artery in the third part, or beyond the scalenus, have been detailed at p. 141.

Should the less usual operation of tying the second part of the artery be resorted to, the clavicular piece of the sterno-mastoideus and the anterior scalenus would have to be cut through. In dividing the scalenus great care should be taken of the phrenic nerve, 3, on its front. Ordinarily the external jugular vein lies outside the scalenus: with the position here taken it would need to be cut through, and the ends would require to be tied.

*Branches of the subclavian artery.* At their origin the branches are concealed by the jugular vein and the anterior scalenus, but in Plate xxiv. most may be seen. From the first part come the vertebral, the thyroid axis, and the internal mammary; and from the second part, the upper intercostal, with a small branch to the spinal canal (Quain).

1. The *vertebral* is the first branch, and ascends to the brain through the apertures in the six upper cervical vertebræ.

2. The *thyroid axis*, a short thick trunk, splits into the three following;—*Inferior thyroid*, *d*. This is a tortuous artery, and ends in the thyroid body: an offset, the *ascending cervical*, *f*, lies between the anterior scalenus and the larger anterior rectus, supplying offsets to both, and to the spinal canal. The *transverse cervical*, *h*, crosses the scalenus, and ends under the trapezius by dividing into two. The *supra-scapular*, *l*, courses along the acromion to the scapula, on the dorsum of which it ramifies.

3. The *internal mammary*, *n*, arises opposite the vertebral and beneath the jugular vein: it enters the thorax through the upper opening, and is continued to the wall of the abdomen.

4. The *superior intercostal* (intercosto-cervical) arises under the scalenus: it supplies offsets to the upper two intercostal spaces and a large branch to the back of the neck (deep cervical), which is delineated in Plate xix.

#### SUBCLAVIAN AND JUGULAR VEINS.

The veins of the arm and of the same side of the neck meet at the top of the thorax, and blend in one large trunk—the innominate: the limb vein is called subclavian, and the neck vein jugular.

*p.* Subclavian vein.  
*r.* Internal jugular vein.  
*s.* External jugular vein.

*t.* Transverse cervical vein.  
*v.* Anterior jugular vein.  
*w.* Supra-scapular vein.

The *subclavian* vein, *p*, is rather shorter than its corresponding artery, and ends near the inner border of the scalenus by joining the internal jugular to form the innominate trunk. Arched like the artery, it is placed in front of the scalenus, and commonly below the level of the clavicle. Valves exist in the trunk outside the place of entrance of the external jugular, *s*.

The veins joining it are the external and anterior jugular and the vertebral. At the back of the vein, near the internal jugular, the right lymphatic duct opens; and at a similar spot on the left side the thoracic duct is received.

*External and anterior jugular veins.* The ending of these veins is seen in this Plate, and their course is described in p. 143. The external jugular, *s*, receives the transverse cervical branch, *t*, and the supra-scapular, *w*, and joins the subclavian vein outside the scalenus anticus. The anterior jugular, *v*, enters either the subclavian vein or the external jugular: when this vein is tributary to the external jugular it wants valves (Struthers).

*Internal jugular vein, r.* The lower dilatation of the vein



laid bare. Before its junction with the subclavian it is narrowed, and at the less wide part is a pair of valves to prevent the blood rushing backwards to the neck.\*

The *innominate* is the large venous trunk formed by the union of the subclavian and internal jugular veins: it enters the chest, and joins with its fellow in the upper cava. The connections of the vein in the neck may be studied in the Figure.

NERVES OF THE SUBCLAVIAN REGION.

Most of the nerves are continued to distant parts, only two being distributed to the neighbouring muscles.

- |                                |                            |
|--------------------------------|----------------------------|
| 1. Great auricular nerve.      | 7. Seventh cervical nerve. |
| 2. Superficial cervical nerve. | 8. Eighth cervical nerve.  |
| 3. Phrenic nerve.              | 9. Supra-scapular nerve.   |
| 4. Descendens noni nerve.      | 10. Vagus nerve.           |
| 5. Fifth cervical nerve.       | † Nerve to the subclavius. |
| 6. Sixth cervical nerve.       |                            |

The *diaphragmatic* (phrenic) nerve, 3, springs from the fourth spinal nerve in the cervical plexus, and is sometimes connected with the fifth spinal as it passes by that trunk. In the neck it courses over the anterior scalenus muscle, crossing from the outer to the inner edge; and entering the chest beneath the innominate vein, it is transmitted through that cavity to the diaphragm. It is the motor nerve of the diaphragm.

*Descendens noni* nerve, 4. For the beginning of this branch of the hypoglossal, see Plate xvii. At the lower part of the neck it ends in branches for the sterno-hyoideus, G, sterno-thyroideus, H, and the posterior belly of the omo-hyoideus, D, as well as the anterior belly of the same muscle.

*Brachial plexus.* The lower four cervical nerves, 5, 6, 7, 8, join with the first dorsal to form the plexus. The branches of the plexus above the clavicle are enumerated in p. 146; but only

\* These valves were first described by Dr. Struthers. See an account of them in the Edinb. Med. Journal for Nov. 1856, p. 241.

two, nerve to the subclavius, †, and the supra-scapular, 9, are seen in a front-view of this region.

The *vagus nerve*, 10, passes through the neck and thorax to the belly. At the lower part of the neck, on the right side, it occupies the interval between the jugular vein and the carotid artery and crosses over the subclavian artery but beneath the innominate vein.

It furnishes a small cardiac branch near the subclavian artery and close below that vessel it sends backwards the recurrent or inferior laryngeal nerve.

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## DESCRIPTION OF PLATE XIX.

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A VIEW of the deep muscles, and of the vessels and nerves at the back of the neck, is here given.

After the integuments and the superficial muscles have been reflected the complexus is to be divided near the head; and this last muscle being thrown down and out, the vessels and nerve are to be sought in the dense tissue and fascia in which they are imbedded. Lastly, the muscles are to be defined.

### DEEP MUSCLES OF THE NECK.

Extensor and rotator muscles of the head and neck lie beneath the complexus, B. Between the head and the first two vertebrae and corresponding with the interspinales, are placed the rectus muscles; and laterally there are two other small muscles, the obliqui. Occupying the vertebral groove is the semispinalis colli.

- A. Sterno-mastoideus.
- B. Complexus cut through.
- C. Semispinalis colli.
- D. Obliquus inferior.

- F. Obliquus superior.
- G. Rectus posticus major.
- H. Rectus posticus minor.

The *complexus muscle*, B, is attached by the outer edge to the

transverse processes of the upper dorsal vertebræ, and to the articular processes of the cervical vertebræ, except the first two; and by the inner edge it is connected with the spines of one or two lower cervical and upper dorsal vertebræ. It is inserted into the mid part of the occipital bone between the curved lines.

Towards the inner edge a piece of the muscle possesses a middle tendon, and this is often described separately as the *biventer cervicis*.

If the muscles of both sides act they will maintain the head erect, or will bring it back (raising the face) according to the degree of contraction; but supposing only one to contract, the occiput will be inclined down and out towards the transverse processes of the same side.

*Semispinalis colli*, C. Filling the vertebral groove with the multifidus spinæ, it is attached externally, like the preceding muscle, to the transverse processes of the upper dorsal vertebræ, and to the articular processes of the cervical vertebræ, except the first three; and internally it is inserted into the spines of the cervical vertebræ below the first.

Acting with its fellow it extends the spine: by itself, it rotates the spine, turning the face to the opposite side.

The *obliquus inferior*, D, slants between the first two vertebræ: it arises from the spine of the axis, and is inserted into the transverse process of the atlas.

Drawing backwards the lateral part of the atlas it rolls this bone round the odontoid process of the axis, and rotates indirectly the head, moving the face to its own side.

The *obliquus superior*, F, arises from the transverse process of the atlas, where the preceding is attached, and is inserted into the occipital bone between the curved lines, and near the mastoid process.

The muscle can draw back the head; and may check a too great forward movement, as in nodding.

The *rectus posticus major*, G, arises from the spine of the second vertebra; and widening as it ascends obliquely, it is inserted into the outer half of the lower curved line of the occipital bone, where it is partly concealed by the obliquus superior.

This muscle extends the head, and brings the face to its own side by moving the atlas round the odontoid process of the axis.

*Rectus posticus minor*, H, arises from the arch of the atlas, close to the middle line; and is inserted into the inner half of the lower curved line of the occipital bone. The muscle extends the head.

#### ARTERIES OF THE BACK OF THE NECK.

Three arteries supply the back of the neck, and connect the vessels of the head with those of the trunk. In the neighbourhood of the thorax small offsets of the dorsal arteries appear.

- |  |   |
|--|---|
| <p><i>a.</i> Occipital artery.</p> <p><i>b.</i> Deep cervical branch of the occipital.</p> <p><i>c.</i> Offset to the small rectus muscle.</p> <p><i>d.</i> Vertebral artery.</p> <p><i>e.</i> Cervical branch of the vertebral.</p> | <p><i>f.</i> Anastomosis of the vertebral and deep cervical arteries.</p> <p><i>g.</i> Deep cervical artery.</p> <p><i>h.</i> Dorsal arteries — the inner branches.</p> |
|--|---|

The *occipital artery*, *a*, courses to the integuments of the back of the head over the obliquus superior and the complexus, and beneath the sterno-mastoideus, the splenius, and the trachelo-mastoideus : near the middle line it pierces the trapezius.

It furnishes a *cervical* branch, *b*, to the neck (ram. principis cervicis), which descends beneath the complexus, B, supplying the deep muscles, and anastomoses with branches of the vertebral and deep cervical arteries. An offset passes over the complexus and supplies the superficial muscles.

The *vertebral artery*, *d*, in its course to the interior of the skull is directed backwards in a groove on the neural arch of the atlas. Lying deeply in the bottom of the hollow between the large rectus and the oblique muscles, it furnishes one or two muscular offsets, *e*, and communicates with the contiguous arteries.

The *deep cervical artery*, *g*, is the dorsal offset of the upper intercostal (p. 170), and reaches the back of the neck by passing

between the transverse processes of the last cervical and first dorsal vertebræ. At the back of the neck it ascends under the complexus as high as the axis, where it communicates with the two arteries before described. It supplies chiefly the complexus and the semispinalis colli.

The height at which the artery appears is very uncertain; and it may be represented by two branches of different arteries. In obstruction of the circulation in the common carotid the blood will be conveyed to the exterior of the head by means of the anastomosis between the profunda and the occipital artery.

The *companion veins* of the arteries have not been included in the Plate: they resemble the arteries, with the exception of the vertebral which begins on the back of the head and neck, and does not enter the skull.

#### NERVES OF THE BACK OF THE NECK.

The anatomy of the posterior primary branches of the cervical nerves beneath the complexus is here shown. A part of the small occipital nerve appears behind the ear.

- |                                 |                            |
|---------------------------------|----------------------------|
| 1. First or suboccipital nerve. | 5. Fifth cervical nerve.   |
| 2. Second cervical nerve.       | 6. Sixth cervical nerve.   |
| 3. Third cervical nerve.        | 7. Seventh cervical nerve. |
| 4. Fourth cervical nerve.       | 8. Small occipital nerve.  |

The *first nerve*, 1, appears beneath the vertebral artery, and ends in branches to the complexus, and the recti and obliqui muscles: it is joined to the second nerve by a loop.

*Other cervical nerves.* The remaining seven cervical nerves divide into two—inner and outer branches, as soon as they leave the spinal canal.

The *external branches* are not laid bare except that of the second: they are small, and are distributed to the muscles outside the complexus, viz., splenius, cervicalis ascendens, and transversalis colli and trachelo-mastoideus.

The *internal branches* are directed inwards—the four highest over, and the remaining three through the semispinalis colli;



and at the spines of the vertebræ those that lie on the semi-spinalis become cutaneous. They supply the complexus and the muscles filling the vertebral groove, with the interspinales. The following are the chief differences in these nerves:—

The branch of the second nerve, 2, the largest of all, pierces the complexus and trapezius, and becoming cutaneous is distributed to the occiput: it is named *great occipital*, and is joined by the small occipital nerve, 8. It supplies branches to the inferior oblique and complexus muscles; and it communicates by loops with the first and third nerves.

The cutaneous part of the third nerve, larger than those below it, sends upwards a branch to the occiput, which joins the large occipital nerve.

The connecting pieces between the inner branches of the first three nerves are sometimes absent. M. Cruveilhier describes this looped arrangement as the posterior cervical plexus.

The *small occipital nerve*, 8, is an offset of the cervical plexus (Plate xv.): it ends in the integuments of the occiput, and joins the great occipital nerve.

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## DESCRIPTION OF PLATE XX.

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IN this dissection of the pterygoid region the muscles of mastication, and the internal maxillary artery with its branches can be studied. Most of the branches of the inferior maxillary nerve come also into sight.

This superficial dissection will be made by detaching and throwing down the zygomatic arch with the masseter muscle by sawing off and raising the coronoid process with the temporalis muscle: and by removing the piece of the ramus of the jaw between the condyle and the dental foramen. After each sawing of the bone the fat is to be carefully removed

## MUSCLES OF MASTICATION.

The muscles employed in mastication are attached chiefly to the angle and processes at the back of the lower jaw ; but one, which occupies the cheek, blends with the lip-muscles.

- A. Temporal muscle.
- B. External pterygoid muscle.
- C. Internal pterygoid muscle.
- D. Buccinator muscle.
- E. Masseter muscle.
- F. Digastric muscle (posterior belly).

- H. Stylo-hyoideus.
- L. Stylo-glossus.
- N. Internal lateral ligament.
- O. Styloid process.
- P. Duct of the parotid gland.

The *temporal muscle*, A, arises from the temporal fossa on the side of the skull, and from the upper part of the temporal fascia ; and the fibres converge to a tendon which is attached to the under surface of the coronoid process, and to the groove along the fore part of the ramus of the jaw.

Comparatively superficial above, the muscle passes below beneath the zygomatic arch and the masseter muscle, and rests on the external pterygoid, B. Near the zygoma a stratum of fat intervenes between the fleshy fibres and the temporal fascia.

In mastication this muscle crushes the food by raising the lower jaw ; and if the jaw has been moved forwards, the hinder fibres may be able to bring that bone backwards, with the aid of the muscles attached to the chin.

The *masseter muscle*, F, is placed external to the ramus of the jaw. It takes origin from the lower border and the inner surface of the zygomatic arch ; and it is inserted into the outer surface of the ramus of the jaw, from the tip of the coronoid process to the angle, and as far forwards as the second molar tooth. The superficial fibres take a direction down and back across the deeper and straighter fibres.

This muscle is the external elevator of the angle of the jaw.

The *internal pterygoid muscle*, C, has a position inside the ramus of the jaw similar to that of the masseter outside. The

muscle arises chiefly from the pterygoid fossa, but below from the palate and upper jaw bones by a process which extends in front of the lower part of the external pterygoid muscle. It is inserted into the inner surface of the angle and ramus of the jaw as high as the dental foramen.

It raises the angle of the jaw in conjunction with the masseter and may be considered the internal elevator of the angle.

The *external pterygoid* muscle, B, is directed almost horizontally back and out from the base of the skull to the condyle of the jaw. Arising from the outer surface of the external pterygoid plate, and from the contiguous part of the great wing of the sphenoid bone as high as the crest, the muscle is inserted into the front of the neck of the lower jaw, and into the interarticular fibro-cartilage.

An interval separates the attachments to the external pterygoid plate and the great wing, through which the internal maxillary artery, *d*, usually passes.

If the muscles of both sides act the jaw is moved downwards and forwards, and the front lower teeth pass beyond the upper. If only one muscle acts, say the right, it draws the condyle of the same side further into the articular socket, and causes the chin to project to the left of the middle line of the head, the grinding teeth of the lower jaw passing laterally over those of the upper jaw.

The *buccinator* muscle, D, forms a thin fleshy layer in the cheek between the mucous membrane and the teguments. It is attached to the jaws opposite the molar teeth, and between the jaws to the back of the mouth to a fibrous band—the pterygo-maxillary ligament. Towards the corner of the mouth the fibres are aggregated together, and entering the lips blend with the orbicularis oris muscle.

In the movements of the lips the muscle retracts the corner of the mouth, and so widens that aperture, and wrinkles the cheek.

In mastication it is applied to the jaws, and prevents the food escaping outside the teeth; when it is paralysed the food distends it and the cheek in an inconvenient manner.

In playing a wind instrument this muscle is flattened, and the fibres are contracted for the purpose of driving the outgoing air through the channel of the mouth; but in the use of a blow-pipe the muscle is distended because the mouth is used as a reservoir, but the fibres contract at the same time, to maintain a continuous and active current of air.

## INTERNAL MAXILLARY ARTERY.

The chief vessel in this dissection is the internal maxillary artery, which is continued through the pterygoid region to the deep parts of the head, the nose, and the palate, supplying many offsets.

|                                  |                                    |
|----------------------------------|------------------------------------|
| External carotid artery.         | <i>g.</i> Deep temporal artery.    |
| Posterior auricular branch.      | <i>h.</i> Buccal artery.           |
| Superficial temporal artery.     | <i>l.</i> Posterior dental branch. |
| Internal maxillary artery.       | <i>n.</i> Facial artery.           |
| Inferior dental branch.          | <i>r.</i> Inferior labial branch.  |
| Branch with the gustatory nerve. | <i>s.</i> Masseteric branch, cut.  |

The *internal maxillary* artery, *d*, is one of the terminal branches of the external carotid, and runs upwards and inwards over or under the external pterygoid muscle to the spheno-maxillary fossa, where it ends in branches for the nose, the palate, and the pharynx. It gives numerous branches, and these are classed into three sets:—one external to the pterygoid muscle, another whilst the artery lies on the muscle, and a third internal to the muscle, or in the spheno-maxillary fossa. The first two sets will be mainly referred to now.

The *first set* of branches, two in number (dental and meningeal), belong to the lower jaw and the skull.

The *inferior dental* artery, *e*, enters the canal in the lower jaw with the nerve of the same name, and supplies the teeth and the lower part of the face. Before it enters the bone, a small offset (mylo-hyoid) descends with a fine nerve in a groove inside the ramus of the jaw.

The *large* or *middle meningeal* artery arises opposite the pre-

ceding, and is concealed by the external pterygoid : it is delineated in Plate xxi., *b*.

A third small artery, *f*, which has not been described by Anatomists, runs with the gustatory nerve, and supplies the cheek, and the floor of the mouth external to the tongue.

The *second set of branches* is distributed to the muscles of mastication as below :—

The *deep temporal*, *g*, two in number, enter the fore and hind parts of their muscle. The *masseteric* branch, *s*, springs in common with the posterior temporal, and enters the hinder border of the masseter : it has been cut in the removal of the muscle. The *buccal* branch, *h*, descends to the cheek and the buccinator muscle : it anastomoses with the facial artery. Branches to the pterygoid muscle are shown in Plate xxi.

*Third set of branches.* Only one of these branches, the *posterior dental*, *h*, is seen in the dissection. It takes a tortuous course to the front of the upper jaw, where it communicates with the inferior orbital : it will be given more fully in Plate xxiii.

The *facial artery*, *n*, also a branch of the external carotid (Plate xvii.), is displayed as it crosses the jaw. It ascends with a wavy course to the root of the nose, passing near the corner of the mouth.

Named branches supply the lips and the nose, and one of them to the lower part of the face is the *inferior labial*, *r*. Unnamed branches ramify in the cheek, and anastomose with the buccal and transverse facial arteries.

#### MAXILLARY AND FACIAL VEINS.

*t.* External jugular vein.  
*v.* Superficial temporal.  
*w.* Internal maxillary vein.

*x.* Facial vein.  
*z.* Deep facial, or anterior internal maxillary.

The *facial vein*, *x*, begins near where the companion artery ceases, and crosses the face to the jaw ; but it takes almost a straight line from the root of the nose to the front of the masseter muscle, and does not follow the windings of the facial artery. It ends in the neck in the internal jugular trunk.



Besides branches received from the orbit and the face, it is joined opposite the angle of the mouth by a vein—the *deep facial*, *z*, or the anterior internal maxillary, which brings blood from the pterygoid region and the upper jaw.

*Internal maxillary vein, w.* Only the ending of this in the external jugular remains,—the plexiform continuation of it by the side of the artery having been taken away.

## NERVES OF THE PTERYGOID REGION.

The nerves appearing in this dissection are branches of the inferior maxillary trunk of the fifth cranial nerve, with the exception of two small nerves, one lying along the upper jaw, and another on the lower jaw.

1. Auriculo-temporal nerve.
2. Inferior dental nerve.
3. Gustatory nerve.
4. Masseteric nerve, cut.

5. Buccal nerve.
6. Posterior dental nerve.
8. Buccal branches of the facial nerve.

The anatomy of the inferior maxillary nerve is described with Plate xxi.; but the position of its several branches passing the external pterygoid can be here seen before the muscle is raised.

This large trunk of the fifth nerve is concealed as it leaves the skull by the external pterygoid; and its branches escape through the muscle or at its edges. Appearing at the upper border are the masseteric nerve, 4, and the deep temporal (Plate xxi., 8); and issuing at the lower border are three large trunks, viz., the auriculo-temporal, 1, the dental, 2, and the gustatory, 3. The *buccal nerve*, 5, comes forwards between the two pieces of the pterygoideus externus.

The *posterior dental nerve*, 6, a branch of the upper maxillary trunk, descends along the upper jaw with its artery: its origin and distribution may be referred to in Plate xxiii.

## DESCRIPTION OF PLATE XXI.

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THIS Illustration of the deep dissection of the pterygoid region exhibits the third trunk of the fifth cranial nerve, and the deep branches of the internal maxillary artery.

In preparing the dissection the internal maxillary artery should be cut through, and the condyle of the jaw having been disarticulated should be drawn forwards with the external pterygoid muscle. After the removal of the fat the nerves and vessels will be ready for learning.

### MUSCLES OF MASTICATION.

The muscles described with Plate xx. are met with again in this view, and they are marked with the same letters of reference. A better idea of the wide origin of the external pterygoid is obtained in this Plate.

- A. Temporal muscle.
- B. External pterygoid muscle.
- C. Internal pterygoid muscle.
- D. Buccinator muscle.
- F. Masseter muscle.
- G. Digastric muscle.

- H. Zygoma thrown down.
- L. Condyle of the jaw.
- N. Internal lateral ligament.
- O. Styloid process, and stylomaxillary ligament.

### INTERNAL MAXILLARY ARTERY.

The meningeal and the muscular branches of the internal maxillary artery, which were hidden in Plate xx., are now brought under notice; and the other arteries, which are the same as in the preceding Figure, are marked by the same letters.

- a.* External carotid trunk.
- b.* Large meningeal artery.
- c.* Small meningeal branch.
- d.* Internal maxillary artery.
- e.* Inferior dental branch.
- f.* Branch with the gustatory nerve.

- g.* Deep temporal branches.
- h.* Buccal branch.
- l.* Posterior dental branch.
- n.* Facial artery.
- t.* External jugular vein.

The *large* or *middle meningeal* artery, *b*, ascends to the head beneath the external pterygoid muscle, and enters the skull through the foramen spinosum (p. 119). It supplies branches to the temporal and external pterygoid muscles, an offset to the tympanum through the Glaserian fissure, and the following :—

*Small meningeal branch, c.* Arising from the large meningeal, it enters the skull through the foramen ovale: an offset is furnished outside the skull to the internal pterygoid with the branch of nerve to that muscle.

INFERIOR MAXILLARY NERVE.

The branches of the inferior maxillary nerve, whose lettering corresponds with that in Plate xx., are here traced backwards to the foramen of exit of their trunk from the skull.

- |                             |                                      |
|-----------------------------|--------------------------------------|
| 1. Auriculo-temporal nerve. | 6. Chorda tympani nerve.             |
| 2. Inferior dental nerve.   | 7. Mylo-hyoid branch.                |
| 3. Gustatory nerve.         | 8. Deep temporal branch,             |
| 4. Masseteric branch, cut.  | 9. Branch to the external pterygoid. |
| 5. Buccal branch.           | † Branch to the internal pterygoid.  |

The *inferior maxillary* or the third trunk of the fifth cranial nerve (Plate xiii.) leaves the skull by the foramen ovale, and splits at once into two under the external pterygoid muscle, viz.—an anterior small part, and a posterior large part. And as the nerve is composed of a motor and a sensory root (p. 117), the function bestowed by its offsets will be determined by their receiving filaments from only one or from both roots.

The *small piece* of the nerve breaks up into branches to most of the muscles of mastication as below :—

The *masseteric branch*, 3, courses above the pterygoideus externus and through the sigmoid notch to the under surface of its muscle, in whose fibres it can be followed nearly to the anterior edge: it gives an offset to the back of the temporal muscle.

The *deep temporal* branch, 8, is directed upwards on the skull into the fibres of the temporal muscle, and usually with an artery of the same name.

The *buccal branch*, 5, pierces the external pterygoid, and is continued over the buccinator towards the corner of the mouth ;

it supplies chiefly the buccinator muscle as well as the integuments covering, and the mucous membrane lining the same. In the cheek it joins in a plexus, *buccal*, with the facial nerve (Plate xx., 8). Two masticatory muscles, viz., the external pterygoid and the temporal, receive offsets from this branch.

A branch to the *pterygoideus externus*, 9, enters the under surface of that muscle.

This smaller part of the inferior maxillary nerve contains portions of both roots; these are disposed in a peculiar way, and give different functions to the branches. Thus the nerves furnished by it to the jaw muscles—masseter, temporal, and external pterygoid—are constructed from both roots, like spinal nerves, and give sensibility and contractility to those muscles. The nerve to the buccinator on the contrary is formed altogether by the sensory root, and bestows only sensibility on the muscle and the other parts to which it is distributed.

The larger piece of the *inferior maxillary* nerve ends in three good-sized trunks, and gives a branch to the internal pterygoid muscle.

The *auriculo-temporal* nerve, 1, beginning generally by two roots is inclined backwards beneath the external pterygoid muscle, and ascends finally with the temporal artery to the integuments of the side of the head. It communicates largely with the facial nerve and it supplies also the articulation of the jaw, the meatus of the ear, and the parotid gland.

The *inferior dental* nerve, 2, descends over the pterygoideus internus and the internal lateral ligament to the dental foramen of the lower jaw, and is distributed to the teeth, and the lower part of the face.

A small muscular branch, *mylo-hyoid*, arises from the nerve near the jaw, and runs in a groove in the bone to the anterior belly of the digastricus, and the mylo-hyoideus (Plate xvii.).

The *gustatory nerve*, 3, is directed downwards to the front of the internal pterygoid muscle, near the attachment to the jaw; its further course in the tongue will be represented in Plate xx. Under the external pterygoid muscle it is joined by the chorda tympani nerve, 6.

The *branch* to the *internal pterygoid* muscle, †, comes from the large part of the inferior maxillary trunk, and enters the under surface of its muscle. Around the root of this branch, and on the inner or deep surface of the large trunk, lies the otic ganglion, which furnishes offsets to two other muscles, viz., the tensor tympani and the circumflexus palati : this body can be recognised only in a view from the inner side.

The large part of the inferior maxillary trunk receives fibrils from both roots of the fifth nerve, like the smaller piece ; but as the part contributed by the sensory root is much the largest, most of the branches are formed by this alone, and are therefore sensory in function. The three large trunks, auriculo-temporal, 1, dental, 2, and gustatory, 3, are solely sensory nerves ; and the last is one of the nerves of taste. The muscular branches receiving offsets from both roots, bestow sensibility and contractility on the muscles before mentioned, viz., the pterygoideus internus, the mylo-hyoideus, the anterior belly of the digastricus, the circumflexus palati, and the tensor tympani.

The *chorda tympani nerve*, 6, is a branch of a motor nerve—the facial (p. 117), and issues from the cranium through, or by the side of the Glaserian fissure. It is applied to the gustatory under the external pterygoid muscle, and is conveyed by that nerve trunk to the tongue, where it is distributed : at the point of contact one or two offsets join the gustatory.

The two following pieces of fascia, which are called ligaments, look like distinct bands in consequence of the removal of the rest of the cervical fascia, with which they are continuous.

The *internal lateral ligament* of the articulation of the jaw, N, is attached by one end to the base of the skull, and by the other to the margin of the dental foramen, and to the bone above the insertion of the internal pterygoid muscle : it is part of the deep cervical fascia projecting under the jaw.

The *stylo-maxillary ligament*, O, reaches from the styloid process to the hinder and lower parts of the ramus of the jaw : this piece of the cervical fascia is continuous below with that separating the parotid and submaxillary glands (Plate xvi., N).



## DESCRIPTION OF PLATE XXII.

---

THE dissection of the submaxillary region is indicated in this Figure.

The steps of the dissection are the following :—The soft parts over the jaw are to be divided, and the bone is to be sawn through rather on the right of the symphysis ; then, the tongue having been drawn out of the mouth, the mucous membrane is to be cut along it below, to trace forwards the vessels and nerves.

To make tense the muscles, fasten down the os hyoides with a stitch to one of the firm surrounding parts.

### MUSCLES OF THE TONGUE AND THE HYOID BONE.

Extrinsic muscles of the tongue and elevators of the os hyoides occupy the interval between the tongue and that bone.

- |                              |                                   |
|------------------------------|-----------------------------------|
| A. Mylo-hyoideus, reflected. | J. Inferior constrictor.          |
| B. Genio-hyoideus.           | K. Thyro-hyoideus.                |
| C. Genio-glossus.            | L. Omo-hyoideus.                  |
| D. Hyo-glossus.              | N. Sterno-hyoideus.               |
| E. Stylo-glossus.            | O. Stylo-hyoid ligament.          |
| F. Stylo-hyoideus.           | P. Great cornu of the hyoid bone. |
| G. Middle constrictor.       | Q. Thyroid cartilage.             |
| H. Digastricus.              |                                   |

*Elevators of the os hyoides.* Some of the muscles of this group viz., the mylo-hyoideus, A, the stylo-hyoideus, F, and the digastricus, H, have been described (p. 157) : the remaining elevator is given below.

*Genio-hyoideus*, B. It arises from an <sup>the low genio-hyoid tubercle</sup> eminence inside the symphysis of the jaw, and is inserted below into the centre of the body of the hyoid bone. The muscle touches its fellow along the middle line, and lies between the genio-glossus, C, and the mylo-hyoideus, A.

When the mouth is shut the muscle will raise the hyoid bone

or the os hyoides being fixed, it will help to bring down the jaw, as in the act of opening the mouth.

*Extrinsic tongue muscles.* There are four on each side, viz., hyo-glossus, genio-glossus, stylo-glossus, and chondro-glossus: only the three first are now laid bare.

*Hyo-glossus, D.* This thin muscle arises from the hyoid bone, viz., from the great cornu by one part (cerato-glossus), and from the body of the hyoid bone by another \* (basio-glossus). From this attachment the fibres ascend and enter the side of the tongue.

With the os hyoides fixed the hyo-glossus can depress the tongue in the floor of the mouth, and give to that organ a rounded form. Supposing the tongue the fixed point the muscle will raise the hyoid bone, preparatory to swallowing.

The *stylo-glossus, E*, arises from the styloid process and the stylo-maxillary ligament (Plate xx.), and enters the back of the tongue; but its fibres extend forwards underneath the side of the tongue to the tip where they blend with their fellows.

The muscles of opposite sides contracting will draw back and up the base of the tongue; and by the action of one muscle the point of the tongue will be turned to the same side of the mouth.

*Genio-hyo-glossus, C.* Shaped like a fan, it arises by a narrowed part from <sup>the upper period</sup> a tubercle inside the symphysis of the jaw; and it is inserted along the middle of the tongue from tip to root, as well as into the body of the hyoid bone. In contact with its fellow by the inner surface, the anterior edge is covered by the mucous membrane of the mouth, and the posterior touches the genio-hyoideus, B.

All the fibres contracting the tongue will be sunk in the floor of the mouth, and notably its middle part, so as to give a concavity to the upper surface. If only the lower fibres act they will raise the hyoid bone, and put forwards the tongue between the teeth: by means of the last mentioned fibres the muscle will be able to dilate the pharynx anteriorly.

The *stylo-hyoid ligament, O*, stretches between the end of the styloid process and the small cornu of the hyoid bone. Below, it

\* A third fleshy slip (chondro-glossus), which is attached to the small cornu of the bone, is considered to form part of the muscle.

lies beneath the hyo-glossus, and gives attachment to the middle constrictor, G. Sometimes this band is large and cartilaginous or even osseous ; at other times it is slight, and so membranous as not to be recognised.

The *Pharynx*. In front of the carotid blood vessels is the upper dilated part of the gullet, or the pharynx. Its wall contains thin muscles which overlap one another, and the chief of these are called constrictors : two are marked with G and J, but they will be more fully noticed in Plate xxv.

### SALIVARY GLANDS.

The sublingual gland and parts of the submaxillary and parotid are exposed in the dissection.

R. Sublingual gland.  
S. Piece of the submaxillary.

T. Part of the parotid.  
+ Wharton's duct.

*Submaxillary gland*, S. A deep part of the gland projects beneath the mylo-hyoid muscle, and with it the following excretory duct is connected :—

The duct of the gland, †, (Wharton's,) is about two inches long ; it ascends beneath the gustatory nerve and the sublingual gland to the floor of the mouth, and ends in an eminence on the side of the frænum linguæ.

The *sublingual gland*, R, lies under the fore part of the tongue where it forms a prominence, but it is separated from the cavity of the mouth by the mucous membrane. Elongated from before back, it is about one inch and a half in length, and meets its fellow in front.

Its ducts are numerous (8 to 20), and open for the most part by separate orifices in the floor of the mouth, but some join the duct of the submaxillary gland.

### LINGUAL VESSELS.

The vessels of the tongue are few in number, in comparison with the nerves, there being but one on each side.

- |                             |                                     |
|-----------------------------|-------------------------------------|
| a. Common carotid trunk.    | f. Sublingual branch.               |
| b. External carotid artery. | g. Facial artery, cut.              |
| c. Upper thyroid branch.    | h. Occipital artery.                |
| d. Lingual artery.          | i. Branch of the sublingual artery. |
| e. Ranine branch.           | l. Internal jugular vein.           |

The *lingual artery*, *d*, springing from the external carotid, runs obliquely upwards beneath the hyo-glossus to the under surface of the tongue, where it takes the name *ranine*, and continues along the middle line to the tip—distributing offsets. Near the front of the tongue the arteries of opposite sides correspond with the frænum linguæ in position, and may be cut when that fold of the mucous membrane is snipped with a scissors in tongue-tied infants.

A few named branches come from the artery: the most unimportant is the *hyoid* branch, which supplies one or more of the muscles attached to the os hyoides.

Beneath the hyo-glossus a *dorsal lingual* branch takes its origin. And at the fore part of that muscle arises the *sublingual* branch, *f*, which supplies the gland of the same name and the contiguous muscles, and joins the artery of the opposite side by means of the twig, *i*.

*Lingual vein*.—Its anatomy is similar to that of the artery, and it ends in the internal jugular vein.

#### NERVES OF THE TONGUE.

Six large nerves end in the tongue, three in each half; and the three of the right side are delineated as they course through the submaxillary region.

- |                             |                                   |
|-----------------------------|-----------------------------------|
| 1. Glosso-pharyngeal nerve. | 5. Gustatory nerve.               |
| 2. Hypoglossal nerve.       | 6. Submaxillary ganglion.         |
| 3. Descendens noni branch.  | 7. Loop between the gustatory and |
| 4. Upper laryngeal nerve.   | hypoglossal nerves.               |

The *hypoglossal nerve*, 2 (twelfth cranial, Plate xxiv.), is the motor nerve of the tongue. Coursing with the lingual artery as far as the hyo-glossus it passes over this muscle, and enters the fibres of the genio-hyo-glossus, in which it is continued to the

tip of the tongue, gradually decreasing in size by the supply of offsets.

On the hyo-glossus it furnishes branches to three extrinsic tongue muscles—the hyo, stylo, and genio-glossus; and to one elevator of the hyoid bone—genio-hyoideus. It joins the gustatory nerve, 5, by means of the loop, 7.

The *glosso-pharyngeal* nerve, 1 (ninth cranial), taking the course of the stylo-pharyngeus muscle (Plate xxiv.), enters beneath the hyo-glossus to reach the mucous membrane and the papillæ of the hinder third, and the lateral part of the tongue. Beneath the hyo-glossus muscle it furnishes offsets to the pharynx, the arches of the soft palate, and the tonsil.

The nerve confers sensibility on the mucous membrane of the pharynx, and gives the faculty of tasting in the back of the tongue and in the pillars of the soft palate.

The *gustatory nerve*, 5, coming from the pterygoid region (Plate xxi.), appears between the jaw and the internal pterygoid muscle, and courses forwards along the under surface of the tongue to the tip. At first the nerve rests against the prominence inside the last molar tooth; and in the rest of its extent in the tongue it lies near the edge, covered by the mucous membrane.

Offsets from it supply the mucous membrane of the floor of the mouth, the submaxillary and sublingual glands, and the tongue in front of the distribution of the glosso-pharyngeal nerve—especially the mucous membrane and the papillæ.

As this branch of the fifth cranial nerve does not receive any filaments of the motor root (p. 185) its function is sensory; and the faculty of tasting in the fore part of the tongue is dependent upon it.

*Submaxillary ganglion*, 7. This little body resembles the lenticular ganglion in the orbit (Plate xiv.), and is connected with the branch of the fifth nerve distributed to the tongue. Smaller than the lenticular ganglion, and occasionally reddish in colour, it lies just above the submaxillary gland.

Some branches are furnished to the submaxillary gland and the mucous membrane of the mouth.



Other branches, sometimes called roots, join with the surrounding nerves, like the communicating branches of the lenticular ganglion. Thus the ganglion is connected above with the gustatory—a sensory nerve; with the facial—a motor nerve, by means of the chorda tympani (p. 185), which runs by the side of the gustatory to the tongue, and gives a slender thread to the back of the ganglion; and with the sympathetic through the plexus of that nerve on the facial artery.

## DESCRIPTION OF PLATE XXIII.

IN this dissection the second trunk of the fifth nerve, and a part of the internal maxillary artery, are brought into view.

Supposing the head and the orbit opened, the dissection will be completed by removing the outer wall of the orbit, and the side of the cranium forming part of the middle fossa of the base of the skull.

### SOME MUSCLES OF THE FACE.

Some of the muscles of the eyelids and upper lip being partly displayed will be referred to shortly; the other muscles, viz., those of mastication, have received sufficient notice already.

- A. External pterygoid muscle.
- B. Masseter muscle.
- C. Buccinator muscle.
- D. Levator anguli oris.
- E. Levator labii superioris.

- F. Levator lab. sup. alæque nasi.
- G. Orbicularis palpebrarum.
- H. Rectus oculi superior.
- I. Antrum maxillare.
- L. Obliquus oculi inferior.

*Orbicularis palpebrarum*, G. This thin sphincter muscle occupies the eyelids, forming loops around their aperture, and extends beyond the margin of the orbital cavity.

When the fibres contract the lids are closed, the upper one

being specially brought down; and the integuments around the eye are wrinkled, and drawn towards the nose. In paralysis of the muscle the eyelids cannot be brought together, and the eyeball remains constantly uncovered.

*Elevators of the upper lip.* Three muscles raise the upper lip viz., a common and a special elevator, and an elevator of the angle of the mouth.

The *elevator of the angle*, D, arises from the canine fossa of the upper jaw bone, and blends at the corner of the mouth with other muscles.

The *special elevator*, E, arises from the margin of the orbit over the infra-orbital foramen, and joins the sphincter of the mouth.

The *common elevator*, F, arises from the upper jaw bone at the inner side of the orbit, and ends at the mouth like the preceding: it is attached also to the wing of the nose by a separate slip.

These muscles contracting together will raise the upper lip but the elevator of the angle can act independently of the others and raise the corner of the mouth. Commonly, elevation of the lip and of the wing of the nose follows forced contraction of the sphincter of the eyelids, in consequence of a fleshy slip being prolonged from the orbicularis to the special elevator.

#### INTERNAL MAXILLARY ARTERY.

Two of the terminal branches of the internal maxillary artery at the spheno-maxillary fossa are traced out in the dissection.

- a. Internal maxillary artery.
- b. Posterior dental branch.
- c. Infra-orbital branch.
- d. Buccal branch.
- e. Internal carotid artery in the skull.

- f. Ophthalmic artery.
- g. External carotid trunk.
- h. Superficial temporal branch.
- n. Transverse facial branch.

The *posterior dental* artery, b, springing from the internal maxillary near the spheno-maxillary fossa, is inclined downwards

and forwards over the upper maxilla to the front of the bone, and anastomoses with the infra-orbital artery.

It supplies superficial and deep branches :—the former descend to the buccinator muscle, the periosteum, and the gums ; and the latter enter foramina in the bone, and supply offsets to the ganglia of the teeth and to the lining membrane of the antrum maxillare.

The *infra-orbital* artery, *c*, arises near the preceding, and enters the infra-orbital canal with the upper maxillary nerve. Continued through that canal, it issues at the infra-orbital foramen, and ends in branches for the lower eyelid and the parts between the orbit and mouth : it communicates with the facial, transverse facial, and posterior dental arteries.

Many small offsets are furnished to the orbit ; and near the front of the jaw bone it sends downwards an *anterior dental* branch, with a nerve, 8, of the same name, to supply the incisor and canine teeth.

The *transverse facial* artery, *n*, commonly a branch of the superficial temporal, crosses the side of the face, supplying the contiguous parts, and anastomoses with the facial and the infra-orbital arteries.

## UPPER MAXILLARY NERVE.

The second trunk of the fifth cranial nerve (p. 117) is named as above from passing through the upper maxilla ; it supplies the teeth of the upper jaw.

- |                             |                                  |
|-----------------------------|----------------------------------|
| 1. Posterior dental branch. | 6. Inferior maxillary trunk.     |
| 2. Upper maxillary nerve.   | 7. Buccal branch.                |
| 3. Optic nerve.             | 8. Anterior dental branch.       |
| 4. Orbital branch, cut.     | 9. Branches of the facial nerve. |
| 5. Ophthalmic trunk.        |                                  |

The *upper maxillary* nerve, 2, leaves the skull by the foramen rotundum, and courses to the face across the sphenomaxillary fossa, and through the infra-orbital canal. In the face it splits into large branches which are distributed to the muscles and the integuments between the eye and the mouth : a fine offset

ascends with a small artery to the lower eyelid and the orbicular muscle. Its facial or terminal branches join in a plexiform manner with branches of the facial nerve. It gives off the following branches:—

*Dental branches*:—These are usually two in number, one at the back, and the other at the front of the maxilla.

The posterior branch, 1, descends on the jaw, gradually diminishing in size, and is received into a canal in the bone. Most of its branches course through the bone to supply the grinding teeth, but one or two slender offsets are furnished to the gums and the buccinator muscle.

The anterior branch, 8, is conducted by a bony canal in front of the antrum to the bicuspid and incisor teeth: it sends some filaments to the mucous lining of the nose, and joins the posterior branch.

*Orbital and speno-palatine branches*:—Opposite the sphenomaxillary fossa these remaining branches take origin.

The orbital branch, 4 (temporo-malar), is a cutaneous nerve of the face and temple, and receives its designation from passing through the cavity of the orbit. In the dissection it was exposed necessarily by the removal of the outer wall of the orbit. In its uninjured state the nerve can be traced into the orbit, where it splits into a temporal and a malar branch; these issue to their destination through apertures in the malar bone.

The speno-palatine branches, two in number, descend beneath the internal maxillary artery, and communicating with Meckel's ganglion in the speno-maxillary fossa, supply the lining membrane of the nose and roof of the mouth; the soft palate, and the tonsil; and the mucous lining of the pharynx near the aperture of the Eustachian tube.

The upper maxillary trunk of the fifth nerve springs from the Gasserian ganglion without commixture with the motor root, and is solely a sensory nerve, like the first or ophthalmic trunk. Its influence is due to the sensibility of a part of the face, of the teeth of the upper jaw, of the nose cavity, and of the roof of the mouth and the soft palate.

*Facial nerve*.—This branch, of rather large size, which

marked with 9, is called infra-orbital: it lies below the orbit, and supplies the muscles between the eye and mouth, and on the nose. In its course inwards its offsets cross, and join the branches of the upper maxillary nerve, forming the infra-orbital plexus by this arrangement.

The facial is the motor nerve chiefly of the muscles of the face and head; and it is distributed for the most part to muscles receiving sensibility from the three trunks of the fifth cranial nerve. To the buccinator, which acts as a muscle of mastication as well as a dilator of the aperture of the mouth, it gives the ability to contract; and consequently this muscle is paralysed when the other muscles which are supplied by the facial nerve lose their contractile power.

## DESCRIPTION OF PLATE XXIV.

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This Illustration will serve as a guide to the dissection of the internal carotid and ascending pharyngeal arteries, and of the cranial nerves distributed in the neck.

After the examination of the pterygoid region and the upper maxillary nerve, the dissection delineated will be prepared by detaching the styloid process with its muscles, and the external carotid artery and its branches; and by sawing off the large piece of the side of the skull outside the jugular foramen and the carotid canal. Finally a dense fibrous tissue surrounding the nerves and vessels near the base of the skull should be taken away carefully; and as the internal jugular vein renders obscure the view of many objects it may be removed.

## DEEP MUSCLES OF THE NECK.

Lying on the front of the spinal column are the deep muscles for the flexion and rotation of this part of the spine, and of the



head, which will be now described. And superficial to the level of the carotid bloodvessels is the group of muscles, before referred to in part, which belongs to the pharynx and tongue, and the hyoid bone and the larynx.

- A. Scalenus anticus.
- B. Scalenus medius.
- C. Sterno-mastoideus.
- D. Splenius capitis, cut.
- E. Levator anguli scapulæ.
- F. Obliquus capitis inferior.
- G. Obliquus capitis superior.
- H. Rectus capitis lateralis.
- I. Pterygo-maxillary ligament.
- J. Rectus capitis anticus major.
- K. Longus colli.
- L. Sterno-hyoideus.
- M. Sterno-thyroideus.
- N. Thyroid body.
- O. Omo-hyoideus.

- P. Thyro-hyoideus.
- Q. Hyo-glossus.
- R. Constrictor inferior.
- S. Constrictor medius.
- T. Submaxillary gland.
- U. Styloid process, cut off.
- V. Stylo-glossus.
- W. Stylo-pharyngeus.
- X. Constrictor superior.
- X'. Buccinator.
- Y. Levator palati.
- Z. Tensor palati.
- ‡ Cartilage of the Eustachian tube.

The *rectus capitis lateralis*, H, resembles in position an intertransverse muscle; it is attached below to the lateral part of the atlas, and above to the jugular eminence of the occipital bone.

The muscle will approximate the skull to the atlas, and so help in inclining the head towards the shoulder.

The *rectus capitis anticus major*, J, is continued upwards in line with the anterior scalenus. Arising below where the scalenus is attached, viz., from the transverse processes of the 6th, 5th, 4th, and 3rd cervical vertebræ, it ascends, becoming thicker near the skull, to be inserted into the basilar process of the occipital bone.

If the muscles of opposite sides act the head will be bowed forwards; but only one acting it will turn the face to its opposite side, in consequence of its oblique position.

A third rectus muscle (rect. cap. anticus minor) lies between the two preceding, and passes from the atlas to the basilar process of the occipital bone; it is concealed by the vessels and nerves near the head.

The *longus colli* muscle, K, lies on the front of the spinal column, between the atlas and the second dorsal vertebra; and it is attached to the bodies of the vertebræ and to certain of the transverse processes. For the complete display of the muscle the pharynx should be detached.

The muscle bends forwards the spine, and can rotate the same by means of the lateral slips connected with the transverse processes of the vertebræ.

## SUBCLAVIAN AND CAROTID ARTERIES.

In this Illustration the internal carotid artery can be observed throughout; and by means of the Figure a more complete view of some of the branches of the subclavian and carotid trunks may be obtained.

- a. Subclavian trunk.
- b. Vertebral artery.
- c. Internal mammary branch.
- d. Thyroid axis.
- e. Inferior thyroid artery.
- f. Supra-scapular artery.
- g. Transverse cervical artery.
- h. Ascending cervical branch.
- i. Common carotid trunk.
- k. Upper thyroid artery.
- l. Crico-thyroid branch.
- m. External carotid trunk.

- n. Laryngeal branch.
- o. Lingual artery.
- p. Facial artery.
- q. Occipital artery, cut; with a branch to sterno-mastoideus.
- r. Tonsillitic branch.
- s. Inferior palatine branch.
- t. Ascending pharyngeal artery.
- u. Internal carotid trunk.
- x. Internal maxillary artery, cut.
- y. Internal jugular vein, cut.

*Subclavian trunk.*—The arch of the subclavian artery, and the branches of its first part (p. 157) are here represented.

In this body a rare condition of the *inferior thyroid artery*, e, existed; \* the vessel sprang from the vertebral artery, b, instead of the thyroid axis, d, and then took its usual course to the thyroid body, N.

*Common carotid artery*, i.—The extent and situation of the artery, and the nerves in connection with it (p. 158) can be well perceived in this Plate. In this body the arterial trunk splits into two at a point higher than usual.

\* In Mr. Quain's *Surgical Anatomy of the Arteries*, p. 169, it is said to have been seen once.

*External carotid trunk, m.*—Only the lower part of the artery, with its first branches which were not represented or only imperfectly in preceding Plates, has been left in the dissection. And as the carotid begins above the usual place these first branches have to descend to their destined positions.

The *upper thyroid, k*, runs over the superficial surface of the thyroid body, N, before entering the substance. It furnishes, firstly, muscular offsets; next a laryngeal branch, *n*; and lastly, a crico-thyroid branch, *l*, which lies on the membrane of the same name, joining that of the opposite side, and would be endangered in the operation of laryngotomy.

*Lingual artery, o*:—its hyoidean offset arises before the artery passes beneath the hyo-glossus, Q, and is distributed to the thyro-hyoideus, P.

The *facial artery, p*, furnishes the following branches to the neck before it reaches the jaw:—

A tonsillitic offset, *r*, ascends between the pterygoideus internus and the stylo-glossus, V, and perforating the upper constrictor, X, ends in the tonsil and the side of the tongue.

An inferior palatine branch, *s*, courses along the side of the pharynx between the stylo-glossus and stylo-pharyngeus muscles to the upper border of the superior constrictor, X, where it passes inwards to supply the palate. It supplies muscular branches and one offset long and slender, reaches the Eustachian tube ‡.

Other offsets of the facial, viz., submental and glandular are seen in Plate xvii.

The *ascending pharyngeal artery*, arises near the beginning of the external carotid, and ascends on the spinal column between the pharynx and the internal carotid trunk nearly to the skull. Here it enters the pharynx above the upper constrictor, and ends in branches to the front and back of the soft palate; of these the anterior are the largest, and join with corresponding branches of the opposite side, so as to form two arches beneath the mucous membrane—one lying near the upper, and the other near the lower edge of the velum palati (Quain).\*

\* Fifth edition of Quain's Anatomy, 1846, p. 489.

Branches are given to the contiguous muscles, the lymphatic glands, and the nerves; and one (meningeal) enters the skull through the foramen lacerum, and ends in the dura mater.

The *internal carotid* artery, *u*, ascends through the neck and the temporal bone to the interior of the cranium, and terminates in branches for the brain and the orbit.

The cervical part of the vessel, of the same size throughout and devoid of branches, lies by the side of the pharynx, and rests on the rectus anticus, *J*. At first the artery is accessible in an operation (p. 160), but it becomes deep afterwards beneath the parotid gland and the digastricus, and the styloid process and its muscles.

The internal jugular vein is contained in a sheath of fascia with the artery, and is external or posterior to it.

Numerous nerves are in contact with the vessel. Crossing it superficially from above down are the glosso-pharyngeal, 1, the pharyngeal branch of the vagus, 5, and the hypoglossal nerve, 7; and beneath it, also with a cross direction, are the pharyngeal branches of the sympathetic, the upper laryngeal, 3, and the external laryngeal, 4. In the sheath between it and the vein, and parallel to it, lies the vagus nerve, 2; and behind the sheath and parallel, is placed the sympathetic nerve with its branches. Close to the skull the cranial nerves issuing by the foramen jugulare and anterior condyloid foramen interpose between the artery and vein, but they diverge afterwards to their destination.

In the temporal bone the artery becomes flexuous, and fills the carotid canal, only a few branches of the sympathetic ascending around it: here it gives a small tympanic branch to the ear, which pierces the bone.

For the anatomy of the artery in the skull see Plate xiii. (p. 119); and for the description of the ophthalmic artery refer to p. 122.

#### DEEP NERVES OF THE NECK.

Four cranial nerves, and the sympathetic nerve, with their branches, together with the spinal nerves of the neck, are visible in the Plate.

- |   |   |
|---|---|
| 1. Glosso-pharyngeal nerve.                     | 16. First cervical nerve (loop of the atlas). |
| 2. Vagus nerve.                                 | 17. Second cervical nerve.                    |
| 3. Upper laryngeal nerve.                       | 18. Third cervical nerve.                     |
| 4. External laryngeal nerve.                    | 19. Fourth cervical nerve.                    |
| 5. Pharyngeal branch.                           | 20. Phrenic nerve.                            |
| 6. Spinal accessory nerve.                      | 21. Fifth cervical nerve.                     |
| 7. Hypoglossal nerve.                           | 22. Sixth cervical nerve.                     |
| 8. Descendens noni branch.                      | 23. Seventh cervical nerve.                   |
| 9. Communicating branch from the spinal nerves. | 24. Eighth cervical nerve.                    |
| 10. Recurrent laryngeal nerve.                  | 25. Supra-scapular nerve.                     |
| 11. Cord of the sympathetic nerve.              | 26. Carotid branches of the sympathetic.      |
| 12. Upper cervical ganglion.                    | 27. Upper maxillary nerve.                    |
| 13. Middle cervical ganglion.                   | 28. Optic nerve.                              |
| 14. Lower cervical ganglion.                    | †† Cardiac branches of the vagus in the neck. |
| 15. Middle cardiac nerve.                       |   |

The *glosso-pharyngeal* or ninth cranial nerve, 1, leaves the skull by the jugular foramen, and courses to the pharynx over the carotid artery; passing then beneath the hyo-glossus muscle, Q, it ends in terminal branches for the tongue. In the foramen of exit the nerve possesses two small ganglia, and furnishes a branch (Jacobson's nerve) to the tympanum. Its branches beyond the cranium are the following :—

As it crosses the carotid artery some fine filaments descend on the vessel, and join the sympathetic and the pharyngeal branch, 5, of the vagus.

Muscular branches enter the stylo-pharyngeus and the upper two constrictors; and at the side of the pharynx it joins in a plexus (pharyngeal) with offsets of the sympathetic and of the pharyngeal branch of the vagus.

Numerous offsets are distributed to the mucous membrane of the pharynx opposite the opening of the mouth.

The nerve is chiefly sensory in its function, and it confers on a part of the tongue the faculty of tasting as before said (p. 190); but as the stylo-pharyngeus muscle is supplied altogether by it some motor influence must be obtained from it. By means of its branches to the lining of the pharynx impressions produced by the presence of food are conveyed to the sensorium.

The *pneumo-gastric*, vagus, or tenth cranial nerve, 2, issues from



the skull by the foramen jugulare. In the aperture of exit it has a ganglion (gang. of the root); and it gives a branch to the ear, like the glosso-pharyngeal.

Beyond the skull it is continued through the neck to the thorax, lying in the carotid sheath between the artery and the jugular vein; and as it leaves the neck on the right side it crosses the subclavian artery. Near the skull it is marked by a long fusiform ganglion (gang. of the trunk), which is united with the hypoglossal nerve, 7. In the neck the nerve supplies the undermentioned branches to the pharynx, the larynx, and the heart.

The *pharyngeal* branch, 5, begins in the ganglion, and crosses over (sometimes under) the internal carotid, to reach the pharynx. After being joined by offsets of the glosso-pharyngeal, it communicates with the sympathetic and the superior laryngeal to form the pharyngeal plexus: it ends in the constrictor muscles.

The *upper laryngeal* nerve, 3, arises also from the ganglion, and courses under the carotid to the interval between the hyoid bone and the thyroid cartilage: here it pierces with an artery the thyro-hyoid ligament, and is distributed to the mucous membrane of the larynx. See Plate of the larynx.

Under the carotid it joins largely with the sympathetic nerve; and it furnishes the *external laryngeal* nerve, 4, which supplies the inferior constrictor, and ends in the crico-thyroides muscle (Plate xxv.).

*Cardiac branches*, † †. One springs from the nerve trunk at the lower, and one or two at the upper part of the neck: they join branches of the sympathetic. In this dissection the upper communicated with the descendens noni nerve.

*Recurrent or inferior laryngeal* nerve, 10. On the right side this nerve arises as the vagus enters the thorax, and winding round the subclavian artery, runs back to the larynx: it is distributed chiefly to the laryngeal muscles. See Plate xxvii. On the left side the nerve begins in the thorax opposite the arch of the aorta, round which it makes a loop to come back to the larynx.

In the neck the pneumo-gastric nerve ramifies in the walls of

the air and food passages, and bestows sensibility on the mucous membrane and contractility on the muscular structure ; but the contraction of the muscles supplied not being placed under the control of the will (except those of voice), the nerve resembles more the sympathetic than the other motor cranial nerves.

From the partial mixing of its motor and sensory nerve fibres the branches in the neck have different functions. Experiments seem to determine that the pharyngeal branch is a motor nerve ; the superior laryngeal, chiefly sensory ; and the recurrent laryngeal a motor nerve of the muscles of the larynx, but involuntary motory, and sensory to the muscular fibres in the trachea. The small cardiac branches are probably involuntary motory, and sensory in function like those to the lung.

The *spinal accessory* or eleventh cranial nerve, 6, comes out of the skull by the foramen jugulare, and communicates in that aperture with the vagus by means of an accessory piece.

Beyond the foramen the nerve is directed downwards and backwards to the sterno-mastoideus, which it pierces, and to the Trapezius muscle (Plate xv. p. 146). It joins freely with branches of the cervical plexus, and supplies with them the two muscles named.

This nerve resembles a spinal nerve in arising from the spinal cord, and in being moto-sensory in function ; and this double function is not altogether dependent upon its union with the spinal nerves, for it alone may supply the sterno-mastoideus.

The *hypoglossal*, or twelfth cranial nerve, 7, leaves the skull by the anterior condyloid foramen, and turning over the vagus, with which it is inseparably united, descends as low as the digastric muscle before it is directed forwards to the tongue. No offset is distributed from the first part of the nerve, though it joins the vagus, the sympathetic, and the first spinal nerve ; but many muscular branches arise from the last part of the hypoglossal, as may be seen in Plate xxiii.

It is supposed to be altogether a motor nerve at its origin ; and it is thought that any sensory influence possessed by it is derived from its junction with other nerves near the skull.

*Sympathetic nerve.*—The cervical part of the sympathetic nerve, 11, lies on the spine beneath the great bloodvessels, and is continuous with the knotted cord in the thorax. In the neck it is marked by three ganglia—upper, middle and lower; and each ganglion furnishes external or communicating branches, internal or visceral, and branches to bloodvessels.

The *upper ganglion*, 12, is the largest of the three: it is fusiform in shape, with a reddish colour, and is about two inches long. Near the base of the skull the cranial nerves lie over it.

The outer branches communicate with the first four spinal nerves, and with the tenth and twelfth cranial nerves.

Most of the inner branches pass beneath the carotid to join in the pharyngeal plexus; but one, larger than the rest and named *upper cardiac*, descends beneath the artery to the cardiac plexus in the thorax.

The nerves to bloodvessels from the *ganglion* (*nervi molles*) ramify on both carotid arteries, forming plexuses on them; and on some of the branches of the external carotid there are interspersed ganglia. Through the offset, 26, on the internal carotid the vessels and the vascular membrane of the brain are supplied, and communications take place with the cranial nerves in the middle fossa of the base of the skull.

The *middle ganglion*, 13, variable in size and shape, is placed near the inferior thyroid artery, *e*, and is smaller than the others. Its offsets are the following:—

Outer branches which join usually the fifth and sixth spinal nerves.

Inner branches ramify on the thyroid artery and end in the thyroid body. One of these, the *middle cardiac* nerve, 15, is continued to the cardiac plexus in the thorax.

The *inferior ganglion* lies beneath the subclavian artery and close above the neck of the first rib. It is rather rounded in shape, and is often divided into parts, as in the Figure, where one of the pieces is marked, 14. Its branches are similar to those of the other ganglia.

Outer branches, two or more in number, join the two lowest cervical nerves.

One large inner or visceral branch, *inferior cardiac*, runs beneath the subclavian artery to the cardiac plexus in the thorax.

Offsets to the bloodvessels entwine around the vertebral artery, *b*, forming a plexus on it; and other nerves ramify on the subclavian trunk which they surround with one or two loops.

The branches of the sympathetic in the neck serve chiefly to connect this nerve with others, and to supply the bloodvessels.

By means of the communicating branches with the cranial and spinal nerves the sympathetic gives fibres to, and receives fibres from those nerves; and the offsets joining the anterior primary trunk of each spinal nerve are directed through the roots of the nerve towards the spinal cord, and send also some fibres to the trunk of the nerve to be distributed peripherally with it.

To the bloodvessels the sympathetic gives the power of regulating the quantity of blood circulating through them; so that on section of its nerves (vaso-motory) to them the muscular coat is paralysed, and being unable to contract on the contained fluid, the blood slackens in speed, and congestion of the vessels of the part and increased heat ensue. Stimulating the cut nerves by galvanism will restore for the time contraction of the muscular coat, and will cause a decrease in the congestion and the heat.

*Spinal nerves*.—Eight in number, they are divided equally between two plexuses;—the upper four entering the cervical, and the lower four the brachial plexus.

*Cervical plexus*.—The anterior primary branches of the first four nerves interlace in the cervical plexus: they are marked 16 to 19 inclusive, and the small branch of the first, 16, is named the loop of the atlas. The superficial offsets of the plexus are delineated in Plate xv.; the deep branches follow below:—

*Branches to muscles*.—From the loop between the first two nerves branches are furnished to the contiguous recti muscles; and from the other loops of the plexus the surrounding muscles, viz., the sterno-mastoideus C, Levator anguli scapulæ E, scalenus medius B, intertransversales, trapezius, and the platysma, receive nerves.

*Communicating branches.*—Offsets unite the loop of the atlas with the vagus and hypoglossal nerves, 2 and 7, and with the upper ganglion of the sympathetic, 12. And two small branches from the second and third nerves, 17 and 18 (in this case one comes also from the fourth nerve, 19) join in one, 9, which unites with the descendens noni, and assists to supply the depressor muscles of the hyoid bone.

The *diaphragmatic* or *phrenic* nerve, 20, begins in the fourth cervical nerve, but it often joins the trunk of the fifth nerve, 21, as it passes by. It descends to the thorax over the scalenus anticus A, and inside the internal mammary artery, *c*, as in the Drawing.

*Brachial plexus.*—The lower four nerves are much larger than the upper, and are prolonged to the upper limb. The trunks, marked from 21 to 24 inclusive, issue between the anterior and the middle scalanus,\* and join with part of the first dorsal in the large cords seen in the Figure.

Only two of the branches arising from the plexus above the clavicle are now visible, viz., the supra-scapular 25, and the small nerve to the subclavius; the rest of this set of branches are shown in Plate xv. (p. 145).

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## DESCRIPTION OF PLATE XXV.

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A side view of the pharynx with its muscles is depicted in this Figure.

For this dissection the base of the skull is to be cut through behind the attachment of the pharynx; and the fore part of the head being fixed on a block, and the pharynx distended with tow, the muscles will be easily prepared.

\* In this body the fifth and the fourth cervical came in front of the anterior scalenus.



## THE PHARYNX AND ITS MUSCLES.

The pharynx is the upper part of the alimentary tube which is placed behind the nose, mouth, and larynx. Both the food and air pass along it. It reaches from the skull to the lower end of the larynx, gradually tapering from above down, and measures from five to six inches in length. Above it is inserted into the skull by a thin fibrous membrane called the aponeurosis of attachment of the pharynx; and in front it is fixed to the head, the hyoid bone, and the larynx.

In the wall of the pharynx are contained constricting and elevating muscles, which are employed in swallowing; the latter are engaged in placing the receiving bag in the position required for the entrance of the food or drink, and the former urge onwards to the gullet the morsel received.

- A. Inferior constrictor.
- B. Middle constrictor.
- C. Superior constrictor.
- D. Stylo-pharyngeus.
- E. Levator palati.
- F. Tensor palati.
- G. Buccinator.
- H. Stylo-glossus, cut.
- I. Temporal muscle.
- J. Mylo-hyoideus.
- K. Sterno-hyoideus.

- L. Omo-hyoideus.
- M. Hyo-glossus.
- N. Thyro-hyoideus.
- O. Stylo-hyoid ligament, ossified.
- P. Sterno thyroideus.
- Q. Crico-thyroideus.
- R. Thyroid body, thrown down.
- S. Œsophagus or gullet.
- T. Trachea or windpipe.
- † Pterygo-maxillary ligament.

The *constrictor muscles* are flat and thin, and are three in number on each side, viz. lower, middle, and upper. They are attached in front to the larynx, hyoid bone, and the head, and meet their fellows in the middle line behind: their contiguous edges overlap like scales, the upper being more superficial.

The *lower constrictor*, A (laryngo-pharyngeus) arises from the side of the cricoid and thyroid cartilages of the larynx; and the fibres end in the middle line behind. Its upper edge overlays the middle constrictor B, and the lower is continuous with the circular fibres of the œsophagus.

The *middle constrictor*, B, (hyo-pharyngeus) is connected in front with the hyoid bone, viz. with the great and small cornua,

and with the lower end of the stylo-hyoid ligament, O. The fibres radiate to their ending at the middle line behind, the lower passing beneath the inferior constrictor, and the upper over the superior constrictor to within an inch of the skull.

The *upper constrictor*, C, (cephalo-pharyngeus) is fixed by its anterior edge to the following parts: to the pterygoid plate (lower third of the inner surface) and the hamular process, to the pterygo-maxillary ligament, †, to the lower jaw behind the last molar tooth, to the mucous membrane of the floor of the mouth, and to the side of the tongue. As the fibres pass back to the middle line, the upper form a free curved border below the skull, where the levator palati muscle E enters above them; and the lower are continued beneath the middle constrictor, and blend with fibres of the stylo-pharyngeus.

When these muscles contract, they diminish the size of the pharyngeal cavity by moving forwards the loose hinder part. In swallowing, the two lowest grasp and convey onwards by successive rapid contractions the morsel of food or the drink; whilst the upper one, which is placed above the aperture of the mouth, takes little share in the process, farther than by lessening the space above the mouth, it so far assists in opposing the ascent of the food behind the soft palate. As the tonsil is covered by the upper constrictor opposite the angle of the lower jaw, it may be compressed during the action of that muscle.

*Elevators of the pharynx.* Two muscles on each side, an external and an internal elevator, descend from the head to raise the upper part of the pharynx preparatory to swallowing.

The *levator pharyngis externus*, D, (stylo-pharyngeus) arises from the root of the styloid process, and descends, becoming wider, between the upper and middle constrictors to be inserted mainly into the upper border of the thyroid cartilage, and in part with the upper constrictor muscle.

*Levator pharyngis internus* (salpingo-pharyngeus) is delineated in Plate xxvi. N. It is a small muscular slip inside the pharynx, immediately beneath the mucous membrane, which arises by tendon from the end of the Eustachian tube, O, and joins below the palato-pharyngeus muscle, C.

The elevators make ready the pharynx for receiving the aliment, and they act in this way:—The large elevator draws upwards and outwards the part of the pharynx above the os hyoides, especially the part opposite the opening of the mouth; and elevates the larynx at the same time. And the small or internal elevator raises that part of the pharynx above the large elevator, which would become loose by the action of the other muscle.

Before deglutition takes place the hyoid bone is drawn forwards and upwards by its elevator muscles, giving thus increased size to the pharynx from before back; and the larynx is carried upwards and forwards at the same time under the tongue, so as to allow the opening into the windpipe to be placed in the position most favourable for its closure during the act of swallowing.

#### LARYNGEAL VESSELS.

Two arteries on each side supply the larynx, and the pharynx and windpipe in part.

*a.* Inferior thyroid artery.

*b.* Laryngeal branch.

*c.* Thyroid branch.

*d.* Laryngeal branch of the upper thyroid.

*e.* Lingual artery.

*f.* Internal carotid.

The *upper laryngeal* branch, *d*, is an offset of the superior thyroid artery, and enters the larynx through the thyro-hyoid membrane: its distribution in the larynx can be traced in Plate xxvii.

The *inferior thyroid* artery, *a*, ramifies by the branch, *c*, on the under part of the thyroid body; and sends a branch, *b*, into the interior of the larynx, which is delineated with the other laryngeal artery.

#### NERVES OF THE LARYNX.

Three of the nerves now apparent belong to the larynx and its muscles, and the remaining three enter the tongue.

1. Glosso pharyngeal nerve.
2. Gustatory nerve.
3. Hypoglossal nerve.

4. Upper laryngeal nerve.
6. External laryngeal nerve.
7. Recurrent laryngeal nerve.

The *upper laryngeal* nerve, 4, enters the larynx through the thyro-hyoid membrane with its artery, and ends in the mucous membrane. *† arylenoideo .(?)*

The external laryngeal branch, 6, arises from the preceding high in the neck, and is distributed outside the larynx to the crico-thyroid muscle, Q, and to the inferior constrictor A ; and as it is the only nerve reaching that laryngeal muscle, it must give to the fibres sensibility and contractility.

The *inferior laryngeal* or recurrent nerve, 7, a branch of the vagus, ascends between the gullet and the windpipe, and passes under the inferior constrictor to supply the muscles of the larynx (Plate xxvii.). Muscular offsets are furnished by it to the two tubes between which it lies.

## DESCRIPTION OF PLATE XXVI.

The interior of the pharynx, and the dissection of the muscles of the soft palate, are comprised in this Illustration.

The objects inside the pharynx will appear on slitting down the tube behind, and everting the edges : and the muscles of the soft palate will be laid bare by removing the mucous membrane on the left side, and that layer with some muscular fibres under it on the right, in the manner indicated.

## INTERIOR OF THE PHARYNX.

The pharyngeal cavity reaches from the base of the skull to the lower edge of the cricoid cartilage of the larynx, and tapers from above down. At its middle it serves as a common passage

for the air and food, but the upper part transmits air exclusively, and the lower part conveys only food. These three portions, differing thus in their use, have the following limits:—the upper reaches as low as the opening of the mouth, M, and communicates with the cavities of the nose and tympanum; the middle region extends from the mouth to the aperture of the larynx V; and the third portion lies beyond the larynx, and is continuous below with the œsophagus W. Along the front of the pharynx are seven openings.

- A. Tube of the œsophagus.
- B. Pharynx cut, and reflected.
- C. Inner part of pharynx covered by mucous membrane.
- D. Septum nasi.
- E. Lower spongy bone.
- F. Eustachian tube.
- I. Buccinator muscle.
- K. Soft palate.
- M. Roof of the mouth.
- N. Salpingo-pharyngeus muscle.

- O. The uvula.
- P. Anterior pillar of the palate.
- Q. The tonsil.
- R. Posterior pillar of the palate.
- S. The tongue.
- T. The epiglottis.
- V. Upper opening of the larynx.
- W. Opening of the œsophagus.
- X. Internal pterygoid muscle.
- Z. Mylo-hyoid muscle.

The *Eustachian tube*, F, one on each side, lies close to the base of the skull; on the right side the mucous membrane has been removed from the lower end. Its extremity in the pharynx is cartilaginous and membranous, and is dilatable; but the upper part is osseous, and is contained in the temporal bone. At its lower end the cartilage is enlarged, but more at the inner than the outer side, and gives to the tube a funnel-shaped opening. The pharyngeal aperture is oval from before back, and is placed close behind the internal pterygoid plate, to which the tube is united by fibrous tissue higher up; it is on a level with the inferior meatus,—the upper part of the opening reaching as high as the upper border of the lower spongy bone.

This tube leads from the pharynx to the middle ear or tympanum; it transmits air to the ear cavity, and allows the mucus of that space to escape through it. Ordinarily the lower end is closed, and the air is shut in the tympanum, but the pharyngeal opening can be rendered patent by the action of the palate muscles, so as to permit the passage of air. An instrument can be passed into it through the nose for the purpose of



removing obstruction in the tube, or of conveying air into the tympanum.

The *posterior nares* are the apertures of communication between the two sides of the nose cavity and the pharynx. Each is elongated from above down, and will admit readily the tip of the finger. In the dried skull it is bounded by the vomer internally and the internal pterygoid plate externally, and by the body of the sphenoid above and the palate bone below; but in the fresh state the bones are clothed by the mucous membrane, though without much diminution in the size of the opening. Separating the two is the septum nasi, D.

These apertures allow the air to pass in and out when the mouth is closed. Each is very much larger than the opening in the face of the same side of the nasal cavity; and its increased size will be of use in communicating with the upper part of the nose, and in allowing the outgoing air to ascend towards the roof of the space, and warm the parts that have been rendered cooler in inspiration.

When the lower jaw is immoveably fixed, liquid food can be passed into the stomach by a small flexible tube introduced into the pharynx through the nose and the posterior naris.

In hæmorrhage from the half of the nose the fluid may escape by the nostril, or the posterior naris, or by both those openings when the flow of blood is great; and it may be needful to check the loss of blood by stopping both openings. The aperture in the face can be closed easily; but the posterior naris will have to be plugged through the mouth.

The posterior opening of the mouth, M, is named *isthmus faucium*, and has the following bounds:—Below lies the tongue, S; and above are the soft palate, K, and the uvula. On each side is placed the anterior arch of the palate, P, consisting of a fold of mucous membrane with fibres of the palato-glossus muscle: these folds of opposite sides constitute the pillars of the fauces.

This opening marks the boundary line between the mouth and the pharynx, and all voluntary control over the morsel to be swallowed ceases at that spot. The anterior palatine arches on the sides of the aperture take part in the process of deglutition in

this way :—as soon as the food has been moved backwards by the tongue to the isthmus, the lateral arches are shortened and moved inwards by the contraction of their contained muscular fibres, and shut off with the tongue the cavity of the mouth.

*Upper aperture of the larynx, V.*—This is a single opening, and occupies the middle line just below the mouth. Wide before and narrow behind it is sloped down and back ; it extends upwards rather above the hyoid bone, and downwards to the bottom of the central notch in the front of the thyroid cartilage. In front it is bounded by the wide expanded part of the epiglottis, T ; and behind by the tips of the cornicula laryngis, and by the arytaenoid muscle and the mucous membrane. Laterally it is limited by a fold of mucous membrane (arytaeno-epiglottidean) which stretches from the epiglottis to the arytaenoid cartilage, and contains the depressor muscle of the epiglottis.

Through this hole the air is inspired and expired in breathing and during the respiratory act the space remains open with the epiglottis raised.

When deglutition is about to take place the larynx is moved upwards and forwards under the hyoid bone and the tongue, and the epiglottis is partly lowered ; and during swallowing the epiglottis is placed over the orifice, so as to close it from the passing food or drink, whilst the muscular fibres on the sides and back of the opening contract, and give increased security against the entrance of the aliment into the windpipe. Even when the epiglottis is absent the food does not find its way into the air passage, because the upper part is sufficiently closed by the elevation of the larynx, and by the contraction of the muscular fibres around the upper opening and on each side of the passage lower down. If an attempt is made to take breath during, or too soon after a long draught, some of the fluid is drawn with the air under the partially-raised valve, and produces violent coughing by irritation of the larynx.

The *aperture of the œsophagus, W*, terminates inferiorly the cavity of the pharynx, and is placed opposite the lower edge of the cricoid cartilage : it is circular in form, and is surrounded by the fibres of the lower constrictor.

## THE SOFT PALATE AND THE TONSIL.

The *soft palate* (velum pendulum palati) forms the loose and moveable part of the roof of the mouth, and depends between the nose and mouth cavities. In a state of rest it hangs like a curtain behind the mouth; but it can be moved backwards by muscles to the wall of the pharynx, so as to act like a valve in separating the upper from the middle region of the pharynx.

It is attached above by an aponeurosis to the back of the hard palate; and it is constructed chiefly of muscles covered by mucous membrane. Laterally it is blended with the sides of the pharynx. At the lower edge it is free; and from its centre hangs a rounded elongated part, the uvula, O; whilst on each side two folds, the arches of the soft palate, are continued downwards from it.

The *arches* of the half of the *soft palate*, P and R, begin above, near the middle of the velum, and descend on the sides of the tonsil, Q, diverging from each other. The anterior, P, is continued in front of the tonsil to the side of the tongue near the base; and the posterior is directed behind the tonsil to the back of the pharynx. Each consists of a fold of mucous membrane enclosing muscular fibres: in the anterior fold is the palatoglossus muscle, and in the posterior lies the palatopharyngeus.

*Tonsil, Q.* This body is an aggregate of ten to twenty follicular glands, like those over the root of the tongue (Kölliker), and it occupies the interval between the arches of the palate. Its size varies much. Its situation is marked by the presence of small holes in the mucous membrane, without any surface-prominence; but when enlarged from disease it projects, diminishing thus the size of the isthmus of the fauces, and forms a swelling which may be felt externally near the angle of the jaw.

In its structure it resembles the follicular glands. In the bottom of the holes or depressions on the surface of the mucous membrane, are smaller apertures leading into recesses or follicles; these recesses are lined by mucous membrane, and are set round with closed capsules filled with a grayish fluid, and containing

cells, and bodies like free nuclei. The capsules do not appear to have any apertures.

### MUSCLES OF THE SOFT PALATE.

The muscles of the soft palate act as elevators and depressors. They are four in number on each side; and along the centre lies a thin fleshy slip, which is connected with the uvula.

G. Levator palati muscle.

H. Tensor palati muscle.

J. Azygos uvulæ muscle.

K. Superficial part of the palato-pharyngeus.

L. Deep part of the palato-pharyngeus.

The *elevator muscles*, two in number on each side, G and H descend from the base of the skull, and enter the soft palate at their lower ends.

The *levator palati*, G, arises from the under surface of the apex of the temporal bone, and from the hinder part of the cartilage of the Eustachian tube; entering the pharynx above the upper constrictor (Plate xxiv.) it spreads out in the soft palate, forming a fleshy layer from the attached to the free edge, and unites with its fellow along the middle line.

The muscle contracting carries backwards and upwards the soft palate, placing this in a more horizontal position, and approaching the free edge and the uvula to the back of the pharynx. By that movement the part of the pharynx leading to the nose is much diminished; and if the upper constrictor muscle contracts at the same time the passage may be closed.

The *tensor vel circumflexus palati*, H, has a thin but wide origin from the skull, and from the fore part of the cartilage of the Eustachian tube—the cranial attachment reaching from the navicular fossa at the root of the internal pterygoid plate to the styloid process. Descending along the inner pterygoid plate, the muscle enters the pharynx between two points of attachment of the buccinator muscle (Plate xxiv.) and becoming tendinous turns round the hamular process to be inserted partly into the *os palati*, and partly into the aponeurosis of the palate beneath

the muscles L and G. A small bursa exists where the tendon plays round the curved process of bone.

As this muscle is attached to the immoveable hard palate its action must be more limited than that of the levator; it may assist the special elevator in bringing the side of the soft palate into a more horizontal position, and it will then fix and render tense the same part of the palate.

The two muscles above described are connected with the cartilaginous part of the Eustachian tube, and may act on it. Taking their fixed point below, they are enabled to open that tube which is ordinarily closed, and so to permit air to enter the cavity of the tympanum. During swallowing, and during forced expiration with the mouth and nose apertures closed, they act in the manner indicated; but some persons have the power of opening at will the Eustachian tube, and driving air in expiration into the tympanic cavity, without the nostrils being stopped.

*Azygos uvulae*, J.—This slender muscle shortens the uvula and the middle part of the soft palate, and assists therefore the elevators. It consists of two slips of pale muscular fibres, (only the right is seen,) which arise above from the palate spine and the aponeurosis of the soft palate, and are inserted below into the submucous tissue of the uvula.

The *depressors* of the soft palate, two in number on each side are directed downwards in the folds of the arches of the palate to the tongue and the thyroid cartilage.

The *palato-glossus* (constrictor isthmi faucium) lies in the anterior pillar, P. It is a thin narrow slip, which begins on the front of the soft palate, where it joins its fellow in the middle line; and ends on the side and dorsum of the tongue, as is shown in Plate xxvii.

If the lower end is fixed it can draw down the soft palate, stretching the same, so as to diminish the space between the tongue and the palate; and if both ends are fixed the muscle will be moved inwards towards its fellow, narrowing the isthmus of the fauces, as when a morsel of food is about to be swallowed.

The *palato-pharyngeus* is larger than the preceding and consists



of two layers in the palate, which are separated by the levator palati and azygos uvulae muscles.

The superficial thin layer, K, is close beneath the mucous membrane, and joins at the middle line the muscle of the other side. The deeper and stronger layer, L, unites with its fellow internally, whilst some of the upper fibres are fixed to the aponeurosis of the palate. Both layers meet at the outer border of the palate, and descend behind the tonsil in the fold, R, to be inserted mostly into the back of the thyroid cartilage, but a part blends in the pharynx with the upper constrictor.

Acting from below the muscle will bring down the arch, R, and will approach the same to the uvula : it will also draw down and back the soft palate towards the pharynx.

The *soft palate* from its position and its power of moving plays an important part in breathing, in the use of the blow-pipe, in swallowing, and in vomiting.

In breathing with the mouth open the air may pass through both mouth and nose, or only through the nose, according to the position of the moveable palate. When the air obtains ingress and egress through both cavities at the same time the velum hangs vertically, as in the Drawing, and leaves a space between it and the tongue. When the air is transmitted only through the nose, the palate is applied to the back of the tongue, and shuts off the channel of the mouth.

During the use of a blow-pipe the mouth is first filled with air, and the soft palate is then applied to the back of the tongue to close the mouth behind, whilst the cheek-muscles force out from the oral space through the lips a continuous current of air. At intervals, however, the palate is raised temporarily during expiration for the purpose of refilling with air the cavity of the mouth.

In deglutition the soft palate directs the aliment into its downward channel. As soon as the morsel to be swallowed has reached the back of the tongue the moveable palate is raised, and is arched over it so as to prevent its taking an upward direction towards the nose. The depressor muscles contracting at the same time keep the flap fixed, and prevent its retroversion ; and as the

palato-glossus muscle moves inwards behind the morsel, barring with the tongue its return to the mouth, whilst the palato-pharyngeus forms with the uvula an inclined plane above it, the food is conveyed into the pharynx.

In vomiting the aliment takes a retrograde course from the stomach through the mouth; and the moveable palate is used as a valve to shut off the upper region of the pharynx and the nose. The position of the velum during this act is similar to that occupied by it in deglutition, viz., it is moved somewhat horizontally backwards towards the wall of the pharynx, and the palato-pharyngei with the contracted uvula between them form behind an inclined plane. The soft palate is not capable however of blocking up entirely the tube of the pharynx, for some of the ejected matter is forced by the side of it into the nose cavity.

The influence of the soft palate on the voice seems to be small, though this flap forms part of the winding passage through which the sound is transmitted after its production by the vocal cords in the larynx. In the high notes in singing the palatine arches and the uvula are contracted, but touching them does not produce alteration of the note: this tense state has been thought to increase the resonance of the voice.

#### VESSELS AND NERVES.

The vessels and nerves appearing in this dissection have been noticed in the description of the preceding Plates.

- a.* Ending of the external carotid artery.
- b.* Temporal artery.
- c.* Internal maxillary artery.
- d.* Internal carotid artery.

- e.* Inferior laryngeal branch.
- 
- 1. Gustatory nerve.
  - 2. Recurrent laryngeal nerve.

## DESCRIPTION OF PLATE XXVII.

Figures ii. and iii. show the cartilages and ligaments of the larynx, with the vocal apparatus; and in Figure i. the muscles, vessels, and nerves are displayed.

In the preparation made for Figure ii., the muscles were removed, and the right half of the thyroid cartilage was cut off, except the fore part and the lower cornu; and then the muscles and the mucous membrane beneath the cartilage were taken away to lay bare the vocal cord, and the arytaenoid cartilage of the same side.

Figure iii. exhibits the interior of the air passage in a larynx and windpipe slit down behind.

## HYOID BONE AND THE CARTILAGES OF THE LARYNX.

The cartilages of the larynx can be studied with the aid of Figures ii. and iii.; and like parts in both Drawings are marked by the same letters of reference.

- |   |                                   |
|---|-----------------------------------|
| A. Great cornu of the hyoid bone.       | M. Thyro-hyoid ligament.          |
| B. Body of the os hyoides.              | N. Crico-thyroid ligament.        |
| C. Small cornu of the hyoid.            | O. True chorda vocalis.           |
| D. Thyroid cartilage                    | P. False chorda vocalis.          |
| E. Upper cornu of the thyroid.          | Q. Ventricle of the larynx.       |
| F. Lower cornu of the thyroid.          | R. Rima glottidis.                |
| G. Cricoid cartilage.                   | S. Sacculus laryngis.             |
| H. Arytaenoid cartilage.                | T. Thyro-hyoid membrane.          |
| I. Cartilage of Santorini.              | U. Arytaeno-epiglottid fold.      |
| J. Crico-arytaenoideus posticus muscle. | V. Arytaenoideus posticus muscle. |
| K. Cuneiform cartilage.                 | W. Interior of the trachea.       |
| L. Epiglottis.                          | X. Muscular part of the trachea.  |
|   | Y. Rings of the trachea.          |

The *hyoid* or U-shaped bone is placed between the tongue and the larynx, to both of which it gives attachment. It consists of a

central part or body, and of two lateral pieces on each side—the cornua.

The body, B, is the deepest part of the bone: it is convex and uneven in front, and concave and smooth behind. Elevator and depressor muscles are fixed into the fore part; and by its upper edge its gives attachment to the fibrous membrane of the tongue, and that of the larynx.

The cornua articulate with each side of the body. The large one, A, projects backwards behind the tongue, and is joined by muscles of the pharynx, larynx, and tongue. The small cornu, C, is a short rounded process, to which the stylo-hyoid ligament (X, Fig. i.) is connected.

*Cartilages of the larynx.* There are several pieces of cartilage in the larynx as in the trachea; but they differ in their nature. One set resembles the permanent cartilages of the ribs, and like them is prone to ossify; the other set, consisting of small pieces, is constructed of yellow cartilage, as in the eyelid, and is not transmuted into bone.

The large and firm cartilages, which are more or less ossified in the adult, are more immediately connected with the vocal cords: they are four in number, viz., the thyroid, cricoid, and two ary-tænoid.

The *thyroid* cartilage, D, is the largest and highest, and is named from protecting the rest like a shield. It is formed of two similar halves, which are widely separated behind, and are united in front at an acute angle, so as to be prominent beneath the skin (pomum Adami).

Each half ends posteriorly in a rounded thickened border, which is prolonged above and below into a point—the cornua: of these, the upper cornu, E, is the longest, and the lower one, F, articulates with the cricoid cartilage.

Externally muscles of the pharynx and larynx are fixed into the thyroid; and internally it receives the insertion of the vocal cords and of the muscles acting on those cords.

The *cricoid* cartilage, G, forms a ring around the air passage, and is much deeper behind than before, like a signet ring. On its upper border at the back are seated the two ary-tænoid carti-

lages; and outside and below these the lower cornua of the thyroid cartilage rest on it. Internally it is smooth and lined by mucous membrane; and externally muscles are attached to it.

The part of the larynx enclosed by this cartilage is quite inextensible; and by means of the great depth of the cricoid behind the arytaenoid cartilages are raised to the height needful for the attachment of the vocal cords to them.

The *arytaenoid* cartilages are something like a pitcher in shape and are placed at the back of the larynx. Each is pyramidal in form, with the base resting on the upper border of the cricoid cartilage, and the apex blending with the cartilage of Santorini. Narrow and smooth internally or towards its fellow, it is wider and rough externally where muscles are inserted into it, Fig. H. Its posterior part is hollowed, and lodges the arytaenoid muscle; and from its fore part projects a spur into which the vocal cord, O, is fixed.

This is the most moveable of the laryngeal cartilages; and the vocal cord and most of the muscles altering the condition of that cord are connected with it, the production and modification of the voice are influenced by its position.

The remaining small cartilages do not take part in the production of the voice, though they may assist in modifying the sound after it is formed, and they are therefore of secondary importance. Five in number, the chief of them acts as a valve to the upper opening of the larynx, and is called epiglottis: the others are in pairs, one being named cartilages of Santorini, and the second cartilages of Wrisberg.

The *cartilages of Santorini*, I, (*cornicula laryngis*) are placed at the tops of the arytaenoid cartilages. Wide below they gradually taper above, the points bending towards each other.

They bound posteriorly the upper laryngeal opening; they are enveloped by the mucous membrane, serve for the attachment of the folds, U, bounding laterally that opening.

The *cartilages of Wrisberg*, K, Fig. ii. (*cuneiform cartilages*) are placed in front of the cornicula one in each arytaeno-epiglottic fold U. Each resembles a grain of rice in shape and size.



use of these is not known: they are not connected to the other cartilages by ligamentous bands.

The *epiglottis*, L, stands in front of the opening into the larynx (Plate xxvi.). Shaped like a leaf, with the wide part up and the pedicle down, it is attached by fibrous tissue to the thyroid cartilage. Its hinder or laryngeal surface has a smooth covering of mucous membrane with apertures for glands in its substance; and the fore part is connected to the tongue by a central and two lateral folds of mucous membrane. From each side is continued the arytæno-epiglottid fold.

This valve is employed in closing the laryngeal opening during deglutition (p. 212). And when placed over the opening during the production of vocal sounds it causes the pitch of the note to be lowered.

#### ARTICULATIONS OF THE CARTILAGES.

The larger laryngeal cartilages are articulated together by means of joints where the extent of movement is great; and the larynx is further united to the hyoid bone above and the trachea below by fibrous membrane.

The *cricoid* and *thyroid cartilages* are articulated at two points, viz., laterally and in front.

Laterally there is a joint on each side between the lower cornu, F, of the thyroid and the side of the cricoid, in which an enclosing capsule and a lining synovial membrane are present. By means of this joint the front of the thyroid cartilage can be approximated to or removed from the cricoid. When the thyroid is depressed the vocal cords are tightened, and when it is raised or carried backwards they are relaxed.

Anteriorly a strong elastic membrane, *crico-thyroid*, N, closes the interval between the two. By its lower edge it is inserted into the upper border of the cricoid as far back as the arytænoid cartilage. Above it joins the lower border of the thyroid for a short distance, also the spur on the front of the arytænoid; and between those fixed points it forms a free edge, O, the vocal cord. This free upper edge can be tightened or rendered lax by the thyroid cartilage being depressed or raised.

Between the *arytænoid* and *cricoid cartilages* there is a very moveable joint with a fibrous capsule surrounding the articulating surfaces, and a synovial membrane lubricating them. In this joint the arytænoid cartilage can slide on the cricoid forwards and backwards, and inwards and outwards; and further, when the arytænoid is controlled by the muscles tending to draw it in opposite directions, it can be rotated round a vertical axis so as to move the anterior spur outwards and inwards.

The condition of the vocal cord, O, is altered by the movement of the cartilage. Thus it is relaxed when the arytænoid is carried forwards, and is tightened when the same is moved backwards and the distance of the cords from one another will be increased and diminished as the two cartilages are moved from and toward each other. In rotation out the cords are separated and made tense, and in rotation in they are approached, but without being relaxed.

The smaller or accessory cartilages are articulated by ligamentous bands, but have not moveable joints as in the large cartilages.

The *cartilages of Santorini* are united to the top of the arytænoid by surrounding fibrous tissue: but at times there is some indication of a joint between the base of the one and the apex of the other.

The *epiglottis* is fixed below by a band (thyro-epiglottid) to the thyroid cartilage, close below the notch in the upper border; and in front it is united to the back of the hyoid bone by fibrous tissue—the hyo-epiglottid ligament.

The larynx joins the trachea below by a membrane similar to that connecting the rings of this tube; and it is attached to the hyoid bone above by the following ligament.

The *thyro-hyoid* membrane, T, is thin for the most part, but forms rounded thicker cords behind—the thyro-hyoid ligament M. It is inserted below into the upper edge of the thyroid cartilage; but it is continued onwards to the upper edge of the hyoides, muscles shutting it out from the lower edge of the bone: a synovial membrane intervenes between the two.

## INTERIOR OF THE LARYNX AND THE VOCAL APPARATUS.

The larynx or the dilated upper part of the windpipe is wider above than below; and the space enclosed within the cartilages varies in form and size at different points. As a whole the larynx measures about one inch and a half from above down, one inch and a quarter across at the top, and about an inch across at the lower part.

The laryngeal cavity (Fig. iii.) communicates above with the pharynx by the epiglottid aperture, and below with the trachea. By means of muscles and the mucous membrane the space inside the thyroid cartilage decreases in width from the epiglottis to the level of the vocal cords, O, where only a narrow fissure—the glottis, remains; but just above the vocal cord is a dilatation on each side, Q, which is named the ventricle of the larynx. Beyond the vocal cords the space enlarges to the size of the cricoid cartilage, and becomes circular. Its shape is something like an hour-glass, the glottis, R, corresponding with the narrowest part of that instrument.

*Vocal apparatus.* Under this general term may be included the vocal cords, with the chink or interval between them; and the ventricle of the larynx and its pouch.

The *vocal cords* are two whitish bands on each side, which shine through the mucous membrane, and lie above and below the ventricular space, Q. Both are stretched between the thyroid cartilage in front, and the arytaenoid behind.

The *upper band*, P, or the false vocal cord, forms a curve with the convexity upwards. In front it is fixed to the thyroid cartilage slightly above the middle; and behind to the outer part of the arytaenoid. It consists of a bundle of white fibrous tissue, which is covered by the mucous membrane.

The use of this band is unknown. The voice is not produced by it, for it is removed so far from the centre of the laryngeal space as to be out of reach of the direct current of air.

The *lower or true cord*, O, Fig. ii., is stronger than the other, and is horizontal in direction. It is inserted in front into the

thyroid cartilage about the centre of its depth, and behind into the anterior spur at the base of the arytaenoid cartilage. In the male it measures rather more than half an inch, and in the female rather less. This band forms the upper free edge of the cricothyroid ligament (Fig. ii., N), and consists of a bundle of fine elastic tissue covered by thin mucous membrane.

It has two free surfaces, one internal which looks to its fellow and one above where it bounds the ventricle; and the free edge between those two surfaces is the part that is made to vibrate in the outgoing current of air.

Sound or voice is produced by the expired air throwing in vibration the free edges of the lower two vocal cords. In breathing the vibrating edges are at a distance from each other, and divergent behind, and the air passes by them without sound. In order that voice should be produced those edges require to be approximated and put parallel to each other by muscles, and to be brought into the state called the vocalizing position.

The pitch of the voice varies with the degree of tightness or laxness of the vocal cords. If the cords are loose a deep sound ensues, but if they are tight, a high tone is formed. Alterations in the degree of tension depend upon the action of controlling muscles.

The *glottis* (*rima glottidis*), R, is the narrow interval or chink between the true vocal cords. Its extent is greater than that of the cords, for it reaches across the larynx; and it is bounded on each side by the vocal cord and the arytaenoid cartilage. It measures from before back nearly an inch, and across at the base widely dilated about a third of an inch: both measurements refer to the larynx of the male. In the female the size is less by one or three lines. During inspiration the space is larger than during expiration.

Its form changes with the dilatation. In a state of rest the interval resembles a spear-head with the shaft placed backwards; when dilated it is triangular in form, the base of the interval being behind.

The *ventricle* of the *larynx*, Q, is the hollow between the false and true vocal cords of the same side; and it extends from

thyroid to the arytaenoid cartilage. The bottom of the hollow is wider than the opening into the larynx; and at its upper and anterior part it communicates with the sacculus laryngis, S. Into this hollow the mucous membrane sinks, and, after lining the space, enters the laryngeal pouch.

This space by its position isolates the true vocal cord from the wall of the larynx, and permits the free vibration of that band.

The laryngeal pouch (sacculus laryngis), S, is a small conical bag of the mucous membrane, which projects upwards from the ventricle of the larynx, and when distended reaches as high as the upper border of the thyroid cartilage. Fig. ii. gives an inner view of its position on the side of the epiglottis; and in Fig. i. it is seen from the outside as it rises above the thyro-arytaenoid muscle, P.

Closed and dilated above, the pouch is narrow below; and it opens into the ventricle by a small hole, which is diminished somewhat by a projection of the mucous membrane. Over the outer surface are scattered numerous mucous glands (sixty or seventy in number) which open by small ducts on the inner surface, and pour their secretion over the contiguous parts, viz., the ventricle and the vocal cords.

The *mucous lining* of the larynx forms a fold, U, (arytaeno-epiglottid,) on each side of the upper orifice, and extends through the cavity to the trachea. Furnishing a very thin covering without glands to the vocal cords, it sinks into the ventricle between them, and gives rise to the sacculus. As low as the vocal cords it is loosely united to the subjacent parts by areolar tissue, but it is joined closely to those bands without the intervention of any submucous stratum. In consequence of the closeness of its attachment to the cords the swelling from fluid effused into the areolar tissue in œdema of the glottis does not extend below that point; and thus, though the upper orifice of the larynx may be closed by the swelling, air can be admitted to the lungs by an artificial aperture through the crico-thyroid membrane, N, as in the operation of laryngotomy, because this opening will be situate below the swollen parts.



FIGURE I.—For this Drawing the dissection was prepared by removing the greater part of the right half of the thyroid cartilage, and then taking the areolar tissue from the subjacent muscles, vessels, and nerves. Some nerves which enter the mucous membrane behind the larynx from both laryngeal trunks could not be preserved.

On the right side of the tongue the extrinsic muscles have been defined as they enter it.

In this, as in the other Figures, the hyoid bone, the cartilages of the larynx with some ligaments, and the trachea and the thyroid body are depicted.

- |                            |                                    |
|----------------------------|------------------------------------|
| A. Os hyoides.             | L. The epiglottis.                 |
| B. Thyroid cartilage.      | M. Genio-hyo-glossus.              |
| C. Cricoid cartilage.      | N. Thyro-hyoid membrane.           |
| D. Trachea.                | S. Sacculus laryngis.              |
| E. The tongue.             | T. Thyroid body.                   |
| F. Palato-glossus muscle.  | U. Pyramid of the thyroid body.    |
| G. Stylo-glossus.          | W. Levator glandulæ thyreoideæ.    |
| H. Pharyngeo-glossus.      | X. Stylo-hyoid ligament, ossified. |
| I. Cornicula laryngis.     | Z. Upper part of the œsophagus.    |
| J. Crico-thyroid membrane. |                                    |
| K. Hyo-glossus muscle.     |                                    |

### MUSCLES OF THE LARYNX.

Some of the intrinsic laryngeal muscles act more immediately on the arytaenoid cartilages, approximating them to, or removing them from each other, and control the width of the glottis. Others make tense or lax the vocal cords, and so govern the pitch of the voice. One pair of muscles depresses the epiglottis.

- |                                  |                                 |
|----------------------------------|---------------------------------|
| O. Depressor of the epiglottis.  | R. Crico-arytaenoides posticus. |
| P. Thyro-arytaenoides.           | V. Arytaenoides.                |
| Q. Crico-arytaenoides lateralis. | Y. Crico-thyroideus, cut.       |

*Muscles governing the size of the glottis.*—The interval between the vocal cords can be widened or narrowed by the three following muscles.

The *crico-arytænoides posticus*, R, (J, Fig. iii.) arises from the right lateral depression on the back of the cricoid cartilage, and is inserted above into the base of the arytaenoid cartilage at the outer side.

When this muscle acts the arytaenoid cartilage will be rotated around its vertical axis, and the anterior spur will be moved outwards away from the middle line. By this movement the glottis is widened at the base, and the upper aperture of the larynx is also made larger.

The *crico-arytænoides lateralis*, Q, arises from the upper edge of the cricoid cartilage at the lateral aspect ; and taking a backward direction it is inserted with the preceding into the external prominence at the base of the arytaenoid cartilage, and into the contiguous part of the outer surface.

As the preceding muscle moves outwards the external projection of the cartilage, the lateral crico-arytænoides is put on the stretch ; but as soon as the posterior muscle ceases to contract, the lateral one will restore the displaced cartilage to its usual position. This muscle, acting by itself, will turn inwards the anterior spur, and diminish the width of the glottis.

The *arytænoides*, V, the only single muscle of the larynx, closes the interval between the arytaenoid cartilages. It consists mostly of transverse fibres, which are attached to the hollowed posterior surfaces of the cartilages ; but it possesses also two superficial bands, which are directed from the base of one cartilage to the apex of the other. These oblique slips cross each other at the middle, and join in front the thyro-arytænoides and the depressor epiglottidis.

The fibres of the muscle contracting will draw the arytaenoid cartilages towards each other, and diminish the width of the glottis. And, as this movement approximates the vocal cords, the muscle is one of the two employed in placing the cords in the vocalizing position. The muscle diminishes behind the width of the upper laryngeal orifice.

*Muscles governing the pitch of the voice.*—The muscles making tight or loose the vocal cords, and rendering the voice either high or deep in tone, are the two subjoined.

The *thyro-arytænoideus* muscle, P, lies outside the vocal cord of the same side, to which it is closely united. Anteriorly it arises from the lower half (in depth) of the thyroid cartilage, and from the contiguous crico-thyroid membrane; and it is inserted behind into the base and outer surface of the arytænoid cartilage. Its inner and lower fibres are transverse, but the outer ascend and join the depressor of the epiglottis, O.

Through the action of this muscle the arytænoid will be drawn forwards towards the thyroid cartilage, and the vocal cord of the same side will be relaxed, as when deep or grave sounds are produced. The muscle is supposed (Willis) to have the power of placing the inner vibrating edge of the vocal cord parallel to its fellow.

The *crico-thyroid* muscle, Y, can be seen entire in Plate xxiv. Placed on the front of the larynx, it arises from the side and front part of the cricoid cartilage; and it is inserted into the inferior cornu, and the lower border of the thyroid cartilage nearly to the middle line.

Supposing the attachment to the cricoid cartilage to be the fixed point, the muscles of opposite sides will bring down the thyroid cartilage in front. By this movement the interval between the arytænoid and thyroid cartilages is increased, and consequently the vocal cords are tightened, and put into the state necessary for the production of a high note. If the thyroid be supposed the fixed point, the front of the cricoid will be raised whilst the back of the same with the arytænoid cartilages will be lowered, and the vocal cords will be likewise stretched.

The *depressor of the epiglottis*, O, (thyro-arytæno-epiglottideus) is a thin and indistinct layer of muscular fibres, which is contained in the arytæno-epiglottid fold, U, and consists usually of two parts. The chief bundle of fibres comes from the top of the arytænoid cartilage, where it is continuous with the thyro-arytænoideus and arytænoideus muscles; and the other slip is attached to the thyroid cartilage near the insertion of the epiglottis. The fibres of the muscle ascend on the side of the opening of the larynx, and are inserted into the margin of the epiglottis.

The lower fibres of the muscle cross the top of the saccul

laryngis, and are supposed by Mr. Hilton to compress the sac : this part has been named by him *arytæno-epiglottideus inferior*.\*

In swallowing the epiglottis may be lowered by the action of the muscles of both sides, after the larynx has been elevated ; and the laryngeal orifice can be diminished by the shortening and moving inwards of the arytæno-epiglottid fold. In the production of very deep notes the muscles draw down the epiglottis over the aperture of the larynx.

NERVES OF THE LARYNX.

There are two laryngeal nerves on each side, the superior and inferior. One is supplied nearly altogether to the mucous membrane, and the other chiefly to muscles.

- |   |                                    |
|---|------------------------------------|
| 1. Upper laryngeal nerve.                         | 6. Branch to join upper laryngeal. |
| 2. Branches to the mucous membrane of the larynx. | 7. Branch to muscles.              |
| 3. Branch for the arytænoideus.                   | 8. Hypoglossal nerve.              |
| 4. Branch to join inferior laryngeal.             | 9. Glosso-pharyngeal nerve.        |
| 5. Inferior laryngeal or recurrent nerve.         | 10. Gustatory nerve.               |

The *upper laryngeal* nerve, 1, pierces the thyro-hyoid membrane, and divides into branches. From the branch, 2, offsets are distributed to the root of the tongue, and to the mucous membrane of the larynx ; between the border of the epiglottis and the true vocal cord, one or two pierce the depressor of the epiglottis. The branch 3 enters the arytænoideus muscle, V, and supplying it, passes through to the mucous lining of the larynx. From the branch, 4, offsets are furnished to the pharyngeal mucous membrane ; and this joins finally the recurrent laryngeal nerve.

Before the nerve enters the larynx it gives off high in the neck the external laryngeal branch (Plate xxiv. 4), which ends in the crico-thyroideus muscle, Y, supplying it entirely.

The upper laryngeal is the sensory nerve of the mucous mem-

\* Description of the sacculus or pouch in the human larynx. By Mr. John Hilton. Guy's Hospital Reports, vol. 2. Lond. 1837, p. 519.

brane of the larynx as low as the true vocal cord ; and by its extreme sensibility it guards the upper part of the passage against the entrance of anything but the air. As soon as a particle of food or drink touches the lining membrane, the respiratory muscles are called into play by a reflex act, and the foreign body is expelled by coughing. In the attempt to breathe an irrespirable gas the passage is closed by the contraction of the surrounding muscles, also through a reflex act. When the nerve is cut across in an animal during life the sensibility of the part is lost, and food may enter the larynx.

To the crico-thyroideus muscle, which it supplies alone, it gives motor influence as well as sensibility ; and to the arytaenoides, to which with the recurrent it furnishes offsets, it imparts only sensibility.

The *inferior laryngeal* or recurrent nerve, 5, ascends over the side of the cricoid cartilage, and ends in muscular offsets beneath the thyroid. At first the nerve supplies branches to the mucous membrane of the pharynx, and the communicating branch, 6, which joins the upper laryngeal under the thyroid cartilage. The continuation of the nerve, 7, then terminates in branches for muscles :—one belongs to the crico-arytaenoides posticus, R ; a second, which passes beneath the preceding muscle, enters the arytaenoides, V ; and another gives nerves to the crico-arytaenoides lateralis, Q, and the thyro-arytaenoides, P. In short, the nerve supplies all the special laryngeal muscles except the crico-thyroideus, Y, which receives the external laryngeal branch of the superior laryngeal nerve.\*

The recurrent is the motor nerve of the muscles acting on the

\* Anatomists are silent for the most part respecting the nerve to the muscle here called depressor of the epiglottis ; but Mr. Hilton states (Guy's Hospital Reports, vol. 2, 1837) as the result of " repeated and careful dissections " that it is supplied from the recurrent nerve by means of two filaments which are prolonged from the branch of the same nerve to the thyro-arytaenoides. Neither in my own dissections, nor in those of Mr. P. B. Mason and Mr. J. S. Cluff, formerly Demonstrators of Anatomy, could any separate branch be traced from the recurrent nerve to the muscle. Mr. Cluff made six special examinations of the human larynx, one of the larynx of a donkey, and one of the larynx of a cat.



vocal cords, to all of which, except to the crico-thyroideus, it gives branches. But it must bestow sensibility by means of the offsets ramifying in the mucous membrane.

If the recurrent nerves are cut through, the muscles are paralysed; and as the vocal cords cannot be placed in the vocalizing position, and cannot receive the necessary degree of laxity or tension, voice will not be produced.

#### VESSELS OF THE LARYNX.

Two arteries on each side, which are companions to the nerves, ramify in the larynx; they are named upper and lower laryngeal. Other small arteries from the upper thyroid enter the larynx, below, by perforating the crico-thyroid membrane.

- |  |  |
|--|--|
| <p><i>a.</i> Upper laryngeal artery.</p> <p><i>b.</i> Ascending branch</p> <p><i>c.</i> Descending branch</p> <p><i>d.</i> Communicating branch of the upper laryngeal.</p> <p><i>e.</i> Communicating branch of the lower laryngeal artery.</p> | <p><i>f.</i> Muscular branch of lower laryngeal.</p> <p><i>g.</i> Inferior laryngeal artery.</p> <p><i>h.</i> Branches of superior thyroid artery to the thyroid body.</p> <p><i>k.</i> Branches of inferior thyroid artery to the under part of the thyroid body.</p> |
|--|--|

The *upper laryngeal* artery, *a*, resembles the nerve of the same name in its branches, but it is not distributed so exclusively to the mucous membrane. The offsets, *b* and *c*, supply the mucous membrane from the root of the tongue to the chorda vocalis; and from *c*, arteries are furnished to the muscles, O, P, and Q, under the thyroid cartilage, and to the crico-thyroideus, Y. The branch, *d*, anastomoses with the inferior laryngeal both under the thyroid cartilage, and in the mucous membrane of the pharynx.

The *inferior laryngeal*, *g*, gives branches to the posterior laryngeal muscles, R and V, and to Q in part; and it joins the upper laryngeal outside the thyro-arytænoideus muscle, P. Branches of it enter the mucous membrane of the pharynx, and communicate again with the upper laryngeal by the offset, *e*.

*Veins* accompany the arteries. The upper laryngeal opens through the superior thyroid vein into the internal jugular trunk; and the lower sends its blood into the innominate vein along the inferior thyroid branch.

## THE THYROID BODY AND THE TRACHEA.

In a side view, the thyroid body, T, is only partly visible. This organ is larger in the female than the male, and is more developed in the foetus than in the adult relatively to the rest of the body: its use is not known.

It is placed opposite the upper part of the trachea; and consists of two lobes, right and left, which are firmly attached to the windpipe, and project upwards, one on each side, as far as the thyroid cartilage. A narrow part, the isthmus, joins the lobes below in front of the trachea. Each lobe is pointed above and wide below; and it lies between the larynx and the common carotid artery, where it is covered by the depressor muscles of the hyoid bone (Plate xxiv.).

Projecting upwards from the left lobe, or from the isthmus, is a small tapering part, U,—the pyramid, which is connected to the os hyoides by a band of fibrous tissue. Sometimes, as in the Drawing, a thin muscular slip, W, *levator glandulae thyroideae*, unites the pyramid with the hyoid bone.

Brownish red or purplish in colour, it consists of small masses or lobules about as large as the little finger nail. It does not possess any excretory duct. On cutting into it a thick yellowish fluid escapes from small closed capsules or vesicles.

The swelling of the throat known as a wen or Derbyshire neck, is caused by enlargement of the thyroid body.

*Bloodvessels.*—Two large arteries on each side ramify in this body. The *upper thyroid*, h, a branch of the external carotid, enters the apex of the lobe, but it distributes some branches over the surface, which join the other arteries. The *lower thyroid*, k, is usually larger than the upper, and is a branch of the subclavian trunk: it penetrates the base of the lobe, and offsets ramify over the under surface. All the arteries communicate freely together.

Three large *thyroid veins* issue on each side. Two, upper and lower thyroid, run with the arteries of the same name, and end—the former in the internal jugular, and the latter in the innominate vein. A middle thyroid vein leaves the middle of the

lobe, and crossing the common carotid artery joins the internal jugular trunk.

The *trachea* or windpipe, D, reaches from the larynx to the thorax, and divides in that cavity into two pieces or bronchi—one for each lung. Placed in front of the œsophagus, Z, along the middle line of the body, it is round and firm in front, but flat and soft behind, and is always pervious to the air. Its transverse width is about an inch in the male, but less in the female. Its fore and hinder parts differ much in their composition.

The firm fore part of the tube consists of dense fibrous membrane, which incases separate pieces of cartilage about one sixth of an inch wide, and forming three fourths of a circle. Each piece has its convexity directed forwards; and the whole keep apart the walls of the tube. Behind, where the trachea is flattened, it is constructed by fibrous membrane (X, Fig. iii.) continuous with that containing the pieces of cartilage; and beneath it is a layer of transverse muscular fibres, together with some superficial bundles of short longitudinal fibres.

Lining the trachea is a mucous membrane covered with a columnar and ciliated epithelium; and beneath the same is a layer of elastic tissue which is collected into bundles in the flat part of the tube. Many glands are placed beneath the mucous membrane; and the largest occupy the back of the windpipe, where some are external to the fibrous and the muscular layer.

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## DESCRIPTION OF PLATE XXVIII.

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THESE three Figures of vertical sections of the nose will indicate the boundaries of that cavity, and the openings into it.

For Figure i., the right half of the nasal cavity was cut through vertically, and the septum nasi was removed,—the fore part of

the skull having been previously detached for the dissection of the pharynx.

The nose was sawed through on the left of the septum for Figure ii.; and pieces of the middle and inferior spongy bones were cut out to render evident the openings into the meatuses.

And for Figure iii. the mucous membrane was removed from the septum nasi, after the saw had been carried vertically through the left nasal fossa.

#### BOUNDARIES OF THE NASAL CAVITY.

Some of the boundaries appear in all the Figures, and the same letters of reference are used for them.

- |  |  |
|--|--|
| A. Middle part of the roof of the nasal fossa. | N. Funnel-shaped prominence of the ethmoid bone. |
| B. Fore part of the roof.                      | O. Aperture of the nasal duct.                   |
| C. Back of the roof.                           | P. Opening of the Eustachian tube.               |
| D. Floor of the nasal cavity.                  | Q. Soft palate cut through.                      |
| E. Dilatation within the nostril.              | R. Descending plate of the ethmoid.              |
| F. Upper spongy bone. <i>rest of the</i>       | S. Vomer.  |
| G. Middle spongy bone.                         | T. Cartilage of the septum.                      |
| H. Lower spongy bone.                          | U. Cartilage of the aperture.                    |
| I. Upper meatus of the nose.                   | V. Pharynx.                                      |
| J. Middle meatus.                              | W. Genio-hyo-glossus muscle.                     |
| K. Lower meatus.                               | X. Epiglottis.                                   |
| L. Sphenoidal sinus.                           | Y. Os hyoides.                                   |
| M. Frontal sinus.                              | Z. Thyroid cartilage.                            |

Each half of the nose cavity is a flattened space, which communicates with the face and the pharynx, and with the hollows or sinuses in the surrounding bones. It intervenes between the base of the skull and the mouth, and occupies the interval between the eye sockets. The bones of the face and skull enter into its construction; and the boundaries are named roof and floor, inner and outer wall.

The floor, D, is horizontal and smooth; and its bony framework consists of the palate pieces of the upper maxillary and palate bones.

The roof reaches from the nostril to the posterior naris, and is sloped before and behind. Its centre is formed by the thin cribriform plate of the ethmoid, A, and is nearly straight; the

fore part is made up of the frontal and nasal bones, and the lateral cartilage ; and the hinder part is bounded by the anterior and inferior surfaces of the body of the sphenoid, with the sphenoidal spongy and the palate bones.

The inner wall is the septum or partition between the fossæ of opposite sides. In it are the descending plate of the ethmoid, R, the vomer, S, and the triangular cartilage, T.

The outer wall is marked by projecting osseous pieces with subjacent hollows, and is constructed of several bones. From before back the following is the order of succession, viz. : os nasi, upper jaw, lachrymal, ethmoid, and palate bones, with the internal pterygoid plate of the sphenoid bone. Below the nasal, in front, the lateral cartilage is found.

The width of the nasal fossa is larger below than above ; and at the floor close to the septum is the greatest space available for passing an instrument through the cavity. Across the upper part of the fossa the spongy bones project, so as nearly to touch the septum. From before back the length measures about three inches along the floor, and the depth amounts to two inches at the centre.

In front is the opening called the nostril : this is an elongated hole which is surrounded, except behind, by the cartilage of the aperture, U, and is always open. For the distance of half an inch within the nostril is a dilatation, E, large enough to take the end of the finger, which is lined by skin provided with hairs or vibrissæ. Behind, the space communicates with the pharynx by the posterior naris (Plate xxvi.).

In breathing the air passes ordinarily through the lower half of the nasal fossa, but by sniffing, as in the attempt to recognise faint odours, the current can be directed upwards to the region where the olfactory nerve ramifies.

Through the lower part of the nasal fossa the opening of the Eustachian tube, P, can be reached. To enter that tube an instrument should have the requisite size and curve, and should be directed along the floor close to the septum until it reaches the posterior naris ; then the point is to be turned upwards and outwards into the aperture. In like manner a flexible tube can be passed through



the cavity to the pharynx for the purpose of conveying liquid food into the stomach.

Blood escaping into the nasal cavity from rupture of vessels of the mucous lining requires to be confined within space when the loss of a fresh quantity may be injurious to health or endanger life. In closing the nasal fossa the posterior naris is stopped first by a plug inserted through the mouth in the following manner :—An elongated dossil of lint or cotton wool of the size of the opening is to have a piece of silk or small twine tied around the middle, so as to leave the ends about a foot long. Next, a bit of wire (not too stiff), with a noose at the end and rather curved downwards, is to be pushed along the floor of the nose and behind the soft palate until it can be seen through the open mouth. One of the string ends should be inserted through the noose with a pair of forceps, the other being retained in the left hand. By withdrawing the wire the string will be brought out through the nostril ; and by means of that piece of string the plug can be dragged through the mouth, and round the soft palate with the aid of the left forefinger to the posterior naris. The two strings may be then tied between the nose and mouth. Finally to complete the closure of the nasal cavity the nostril is to have a plug inserted into it.

When the surgeon considers the bleeding not likely to return the plugs are to be taken away. For the removal of the anterior one the proceeding is simple ; but the posterior has to be taken out through the mouth in this way :—The knot on the face being untied, the plug is to be dislodged from the posterior naris by pulling downwards and backwards with a forceps the string in the mouth ; and it is then to be conducted round the soft palate to the exterior of the body.

#### SPONGY BONES AND THE MEATUSES.

Three curved bones, Fig. i., project into the nasal cavity from the outer wall ; they are named from their form spongy or turbinate ; and from their position, upper, middle, and lower. These osseous pieces do not extend the whole length of the outer wall

but are confined to a part limited by two lines continued upwards—one from the front and the other from the back of the hard palate.

The *upper spongy* bone, F, is a process of the lateral mass of the os ethmoides ; and it occupies the posterior half of the interval before mentioned.

The *middle spongy* bone, G, is also a process of the ethmoid, and forms the lower curved edge of the lateral mass of that bone : usually it reaches all across the space included by the two vertical lines.

The *inferior spongy* bone, H, one of the facial bones, is larger than the others, and its length rather exceeds the limits of the space referred to.

The spongy bones are thin and brittle ; and as they are convex on the inner surface and concave on the outer, channels or meatuses exist between them and the wall to which they are attached. They are covered by the mucous membrane, and afford greater surface for the ramifications of the nerves and bloodvessels.

The *meatuses*, Fig. i., are the lengthened spaces between the spongy bones and the outer wall ; and they are the same in number as those bones. Occasionally there is a rudiment of a fourth space above the rest, as in Fig. ii.

The upper meatus, I, less deep and long than the others, communicates with the posterior ethmoidal cells by an aperture or apertures at the fore part (Fig. ii.).

The middle meatus, J, has several openings in it from hollows in the surrounding bones ; and in Fig. ii. the middle spongy bone is represented cut through to show the apertures. At the front of the meatus is an elongated eminence, N, of the ethmoid bone, with two grooves, one before and the other behind it : the anterior groove leads upwards into the frontal sinus, M, and the posterior opens into the anterior ethmoidal cells. Close above the lower part of the prominence referred to, and midway between the letters J and N, is the small round hole of the antrum maxillare.

The inferior meatus, K, receives the ductus ad nasum ; and to see this the lower spongy bone will require to be cut through in front. In the dried bone the canal for the tears has a wide funnel-

*inferior  
ethmoidal  
these c*

shaped end in the meatus ; but in the recent state a piece of the lining membrane of the nose is stretched over the aperture forming a valve for it, and leaves only a small oblique passage for the tears. In the Figure the size of the opening, O, is to be seen. Usually the flap closes the aperture, and prevents air from being driven out of the nose into the lachrymal canals. An instrument entering the duct from below must necessarily injure the valve.

One sinus, viz., that of the body of the sphenoid bone, L, does not open into a meatus : its aperture, which is rather large, may be seen on the slanting hinder part of the roof.

#### THE MUCOUS MEMBRANE AND THE BLOODVESSELS.

The mucous membrane, named pituitary and Schneiderian, clothes the cavity, uniting with the periosteum of the bones, and joins the skin in front, and the lining of the pharynx posteriorly. It is continued over the foramina transmitting vessels and nerves into the cavity, so as to close them ; but it sinks into the apertures leading into the sinuses in the surrounding bones, and lines those air spaces, whilst it diminishes somewhat the size of their openings. Through the nasal duct it is continued upwards to the lachrymal sac, and forms below a thin valve, O, which shuts the opening.

In the lower half of the nasal cavity the membrane is thick and vascular, particularly over the septum nasi and the lower spongy bone ; and it increases the surface of the latter by being prolonged from the lower margin. Its epithelium is columnar and ciliated, except in the dilatation near the nostril where it joins the epidermis and is laminar : at this same spot it is provided with papillæ, and with long hairs or vibrissæ. Large mucous glands abound in the lower part of the nose, and their apertures cover the surface.

In the upper part of the nose the mucous layer is less thick and vascular, and is of a yellowish colour. The epithelium is thick, especially over the olfactory region, and is laminar according to Bowman ; though other observers state that it is ciliated at spots, and is columnar. The glands are numerous. In the olfactory region these resemble the sweat-glands of the skin, and

open in rows between the nerve branches : their long ducts are lined by scaly epithelium.

*Bloodvessels.*—As the *arteries* are not injected, suffice it to say that they are derived chiefly from the internal maxillary, and come through the sphenopalatine foramen. A few enter through the apertures in the roof from the ophthalmic artery ; and near the nostril are branches of the facial. In the pituitary membrane they form a network ; and on the surface and free edges of the two lower spongy bones they ramify in plexuses beneath the membrane.

The *veins* accompany the arteries, and form large venous plexuses on the septum nasi and the middle and lower spongy bones. Through the apertures in the cribriform plate of the ethmoid, the veins of the nasal cavity communicate with those in the cranium.

#### THE OLFACTORY REGION AND THE NASAL NERVES.

In the mucous membrane at the top of the nasal cavity the olfactory nerve ends, and the seat of smelling is located. To this part the term olfactory region has been applied by Mr. Bowman. Its situation is under the cribriform plate of the ethmoid bone ; and it extends down for about an inch on the septum nasi and the outer wall.

Over the limits of this region the mucous membrane is thin, as before said, with thick scaly epithelium, and the glands are like sweat-glands. The vessels construct a network in the adult ; but in the *foetus* Mr. Bowman found on injecting them loops here and there with enlargements, suggesting to him the idea of rudimentary papillæ.

*Olfactory nerve.*—The offsets of the olfactory nerve enter the nose through the foramina in the cribriform plate of the ethmoid bone ; and penetrating the mucous membrane they divide and subdivide in a plexiform manner till they are reduced to the necessary degree of fineness ; but the mode of ending of the nerve-filaments is not known. Recent researches (Schultze) point to the ending of the branches in olfactory or nerve-cells, which resemble somewhat columnar epithelium, and project to the free

surface amongst the cells of the epithelium.\* In their structure the nerve fibrils resemble the sympathetic more than other nerves for they are granular, and are provided with oval corpuscles which become visible on the addition of acetic acid.

Upon this nerve the faculty of recognising odours depends. In ordinary breathing, when the air traverses chiefly the lower part of the nasal cavity, faint odours fail to give indication of their presence; but if the air is carried upwards into the olfactory region by sniffing, the odorous particles diffused in the air will be detected, because they are brought more completely into contact with the nerves. Touching the olfactory region with a solid body, as with a probe, does not excite the sensation of smell. Disease of the brain sometimes gives origin to supposed offensive odours.

*Fifth nerve.*—Through the following offsets of the first and second trunks of the fifth nerve, the pituitary membrane is supplied.

The nasal nerve of the ophthalmic trunk ramifies in the floor of the part of the cavity from the roof to the nostril; and acts as the guardian nerve of the anterior opening by endowing the part referred to with great sensibility. Irritation of the anterior portion of the nasal cavity gives rise through this nerve to the reflex act of sneezing, with the view of dislodging the unusual stimulus by a strong current of air rapidly expelled.

The sphenopalatine branches of the upper maxillary nerve furnish offsets through Meckel's ganglion to all the remainder of the cavity: these branches pass for the most part through the sphenopalatine foramen. Common sensibility, and the nutrition of the mucous membrane, are dependent upon this trunk of the fifth nerve.

\* Manual of Human Microscopic Anatomy. By A. Kölliker. Lond. 1855. p. 604. In this work reference is given to the writings of Herr Schultze.







